

**Republic of Mozambique**  
**Ministry of Mineral Resources and Energy (MIREME)**  
**Universidade Eduardo Mondlane (UEM)**  
**Instituto Superior Politécnico de Tete (ISPT)**

**The Project on Capacity Development  
in Mineral Resources Sector,  
Republic of Mozambique**

**Project Final Report**

**January 2020**

**Japan International Cooperation Agency (JICA)**

**Japan Coal Energy Center (JCOAL)**  
**Mitsubishi Materials Techno Corporation (MMTEC)**

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The Project on Capacity Development in Mineral Resources Sector,  
Republic of Mozambique  
Project Final Report

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## List of Word and Terms

### Relevant Authorities in Mozambique

Abbreviation	Name
CFM	Mozambique Ports and Railways
CPI	Centre of Investment Promotion
DNGM	National Directorate of Geology and Mines
DPD	Directorate of Planning and Cooperation , MIREME
DSP	Directorate of Study and Planning , MIREME
EDM	Electricidade de Moçambique
EMEM	Empresa Moçambicana De Exploração Mineira
ENH	Empresa Nacional de Hidrocarbonetos
HCB	Hidroeléctrica de Cahora Bassa S.A
HRD	Human Resources Department , MIREME
IGM	Institute of Geology and Mines
INAMI	Instituto Nacional de Minas
ISPT	Instituto Superior Politécnico de Tete
MIREME	Ministry of Mineral Resources and Energy
NDM	National Directorate of Mines
UEM	Universidade Eduardo Mondlane
MCTESTP	Ministry of Science and Technology, High Education and Training Vocation
MINEDH	Ministry of Education and Human Development
—	Direcção Provincial dos Recursos Minerals e Energia

### Relevant Authorities in Outside of Mozambique and Japan

Abbreviation	Name
AfDB	African Development Bank
CIL	Coal India Limited
Eni	Ente Nazionale Idrocarburi
ENRC	Eurasian Natural Resources Corporation PLC
GIZ	Deutsche Gesellschaft Fur Internationale Zusammenarbeit
ICVL	International Coal Ventures Private Limited
ITV	Vale Technological Institute
NUFFIC	Netherlands organization for international cooperation in higher education
SIDA	Swedish International Development Cooperation Agency

#### Relevant Authorities in Japan

Abbreviation	Name
JCOAL	Japan Coal Energy Center
JICA	Japan International Cooperation Agency
JOGMEC	Japan Oil, Gas and Metals National Corporation
HIDA	The Overseas Human Resources and Industry Development Association
METI	Ministry of Economy, Trade and Industry
MMTEC	Mitsubishi Materials Techno Corporation
NEDO	New Energy and Industrial Technology Development Organization

#### Support Scheme for the Long-term Training in Japan by JICA

Abbreviation	Name
ABE Initiative	African Business Education Initiative for Youth
Kizuna	The Training Program for Human Resources Development in the Mining Sector

#### Another Word and Terms

Abbreviation	Name
CHPP	Coal Handling Preparation Plant
J-SUMIT2	Japan-Africa Mining & Resources Business Seminar 2015
TICAD	Tokyo International Conference on African Development

#### Technical Term in JICA Project

Abbreviation	Name
C/P	Counter Part
CD	Capacity Development
CDN	Coordinator
G/I	General Information
JCC	Joint Coordination Committee
M/M	Minutes of Meeting
M/M	Man-Month
M/P	Master Plan Study
PDM	Project Design Matrix
PO	Plan Operation
R/D	Record of Discussions
TCC	Technical Coordination Committee

# Brief Summary

## 1. Objective

The purpose of this Project is to improve the organizations of the educational institutions for the promotion of sustainable mineral resources development and raise the educational level of special undergraduate courses to the international standard by improving structures and environment at Universidade Eduardo Mondlane (UEM) and Instituto Superior Politécnico de Tete (ISPT) for effectual experiments and practical training including geological and mineralogical observations and chemical analysis.

## 2. Coverage Organizations and Contents of Implementation

Coverage organizations and contents of implementation of this Project are as follows.

### ➤ Coverage Organizations:

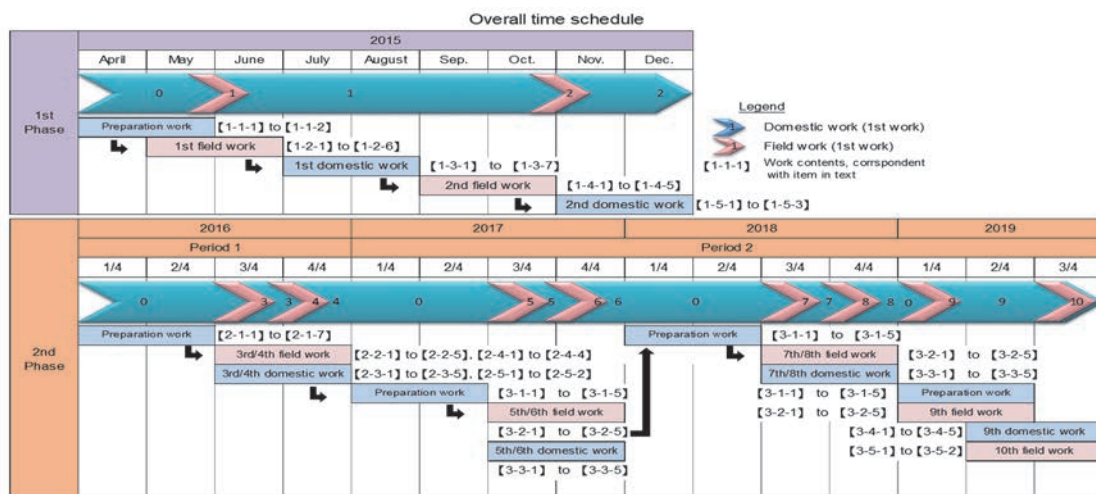
- Ministry of Mineral Resources and Energy (MIREME)
- Universidade Eduardo Mondlane (UEM)
- Instituto Superior Politécnico de Tete (ISPT)

### ➤ Contents of Implementation:

- To consider details of training and select equipment to donate for both universities by baseline survey
- To procure and install the equipment to donate for both universities
- To enhance teachers in both universities through short-term trainings in Japan and Mozambique by using the donated equipment
- To establish methods of maintenance management for the provided equipment in both universities

## 3. Schedule of Project

This project was started in April 2015, which the Phase 1 was performed from April to December in 2015 and the Phase 2 was performed from January 2016 to December 2019. The overall schedule of this project is as follows.



Overall Schedule of this Project

#### 4. Details of Activities (2015 to 2019)

The activities of Short-term Training in Japan and Mozambique conducted from 2015 are as follows.

##### ➤ Activities in Phase 1

#### Baseline Survey, 2015

Training Item/Schedule		Content
Mozambique (1st Training)	25/5~5/6	- Baseline Inspection (gather information of experimental materials, curriculum, laboratory, skills and so on.)

#### Participants

- Consultant: Koichi Tanaka, Toyokazu Sugawara (Japan Coal Energy Center, hereinafter JCOAL)  
Yoshimitsu Negishi, Kinuko Matsunaga (Mitsubishi Materials Techno Corporation, hereinafter MMTEC)

#### Short-term Training in Japan and Mozambique, 2015

Training Item/Schedule		Content	
		UEM	ISPT
Japan (1st Training)	4/10~24/10	Visit to related universities, research institutions, and private enterprises in Japan	
Mozambique (2nd Training)	30/11~11/12	- Final selection of equipment to donate - Model lectures for mineralogy, coal analysis, and geological mapping	- Final selection of equipment to donate - Model lecture for coal analysis, world situation of coal and politics of energy, coal geology, and geological mapping
Selection of Donation Equipment (Jun to December)		- Stereomicroscope, mirror scope, and materials for preparation of chemical analysis	- Simultaneous thermogravimetric analyzer

#### 1st Short-term Training in Japan

##### Trainees

- UEM: Dr. Estevao Inacio Sumburane, Dr. Daniel Luis Ibraimo, Mr. Sérgio Ezequiel Goenha
- ISPT: Dr. Bernardo Miguel Bene, Mr. Arcenio Alberto Ivone Chapot Era,  
Mr. Antonio Ngano Antonio Lisboa

##### Lecturers

- Akita University: Professor Akira Imai, Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences), Professor Katsuyasu Sugawara, Lecturer Takahiro Kato (Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Toyokazu Sugawara, Junko Saito (JCOAL)  
Yoshimitsu Negishi (MMTEC)

#### 2nd Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Professor Akira Imai, Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato

(Faculty of Engineering Science)

- Consultant: Koichi Tanaka, Toyokazu Sugawara (JCOAL), Yoshimitsu Negishi (MMTEC)

➤ Activities in Phase 2

Short-term Training in Japan and Mozambique, 2016

Training Item/Schedule		Content	
		UEM	ISPT
Procurement of Donation Equipment (January to March)		- Stereomicroscope, mirror scope, and materials for preparation of chemical analysis	- Simultaneous thermogravimetric analyzer
Transportation of Donation Equipment (July to December)		- Stereomicroscope, mirror scope, and materials for preparation of chemical analysis	- Simultaneous thermogravimetric analyzer
Mozambique (3rd Training)	26/8~9/9	- Coordination for management and operation of the equipment - Model lecture of ore deposit	- Coordination for management and operation of the analyzer - Model lectures for coal analysis and its utilization, and recovery of valuable metals
Japan (2nd Training)	26/9~21/10	- Practical training for preparation of rock thin section	- Practical training of simultaneous thermogravimetric analyzer
Mozambique (4th Training)	31/10~11/11	- Coordination for management and operation of the equipment - Model lectures for ore deposit, and coal exploration technique by using remote sensing GIS	- Installation of the equipment and instruction for handling of the analyzer - Instruction for coal analysis - Model lectures for sulfur in coal, recovery of valuable metals, and mineral resources mapping

2nd Short-term Training in Japan

Trainees

- UEM: Mr. Terra Eugenio Gove
- ISPT: Mr. Gilberto Rogaciano Goba Sabonete, Mr. Robate Miguel Cardoso Banda, Mr. Terra Eugenio Cossa

Lecturers

- Akita University: Professor Akira Imai, Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato (Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Masafumi Uehara, Junko Saito (JCOAL)  
Yoshimitsu Negishi (MMTEC)

3rd Short-term Training in Mozambique

Lecturers and Coordinators

- Akita University: Professor Akira Imai (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato (Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi (MMTEC)

4th Short-term Training in Mozambique

Lecturers and Coordinators

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi, Shusaku Miyaike (MMTEC)

#### Short-term Training in Japan and Mozambique, 2017

Training Item/Schedule		Content	
		UEM	ISPT
Mozambique (5th Training)	15/5~26/5	- Installation of the equipment and instruction for handling of the equipment - Model lectures for ore deposit, aerial photograph, and coal resource calculation	- Practical training for measuring calcium oxalate using simultaneous thermogravimetric analyzer - Instruction for the method of coal mapping - Model lecture for utilization of the coal analysis using simultaneous thermogravimetric analyzer
Japan (3rd Training)	3/7~28/7	- Practical training of X-ray diffractometer	- Practical training of simultaneous thermogravimetric analyzer
Mozambique (6th Training)	30/10~10/11	- Instruction for handling of the equipment - Discussion of curriculum - Model lecture for hydrothermal deposit	- Practical training for a reaction test of the gasification using simultaneous thermogravimetric analyzer - Consideration of the curriculum - Model lectures for coal chemistry and its utilization

#### 3rd Short-term Training in Japan

##### Trainees

- UEM: Dr. Estevao Inacio Sumburane, Mr. Sergio Ezequiel Goenha
- ISPT: Mr. Albuquerque Leonardo Rimua, Mr. Robate Miguel Cardoso Banda,  
Mr. Terra Eugenio Cossa

##### Lecturers

- Akita University: Professor Akira Imai, Assistant Professor Ryohei Takahashi  
(Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Masafumi Uehara, Junko Saito (JCOAL), Shusaku Miyaike (MMTEC)

#### 5th Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Professor Akira Imai (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Shusaku Miyaike (MMTEC)

#### 6th Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)

- Consultant: Koichi Tanaka (JCOAL), Shusaku Miyaike (MMTEC)

#### Short-term Training in Japan and Mozambique, 2018

Training Item/Schedule		Content	
		UEM	ISPT
Mozambique (7th Training)	28/5~5/6	- Instruction for handling of equipment creating thin section - Consideration of curriculum	- Practical training for a proximate analysis and reaction test of the gasification using simultaneous thermogravimetric analyzer - Consideration of the curriculum - Model lectures for coal gasification and its utilization
Japan (4th Training)	1/10~26/10	- Practical training for separation of zircon and the interpretation - Training for mineral identification	- Practical training for analysis using simultaneous thermogravimetric analyzer - Practical training for titration analysis - Practical training for carbon-sulfur (CS) analysis, inductively coupled plasma (ICP) analysis, and atomic emission spectroscopy (AES) analysis
Mozambique (8th Training)	19/11~30/11	- Practical training for separation of zircon - Consideration of curriculum - Model lecture for ore deposit	- Practical training for a reaction rate analysis using simultaneous thermogravimetric analyzer - Consideration of the curriculum - Model lecture for the oxidation of coal

#### 4th Short-term Training in Japan

##### Trainees

- UEM: Mr. Hernani Vitorino Nhatinombe, Mr. Sergio Ezequiel Goenha
- ISPT: Mr. Neves Semente Jemuca, Mr. Pedro Domingos Dauce

##### Lecturers

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Masafumi Uehara, Junko Saito (JCOAL),  
Yoshimitsu Negishi (MMTEC)

#### 7th Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Shusaku Miyaike (MMTEC)

#### 8th Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi (MMTEC)

Short-term Training in Mozambique, 2019



Training Item/Schedule		Content	
		UEM	ISPT
Mozambique (9th Training)	20/5~31/5	<ul style="list-style-type: none"> <li>- Practical training for separation of zircon</li> <li>- Consideration of curriculum</li> <li>- Preparation for a publication of the training result</li> <li>- Model lecture for ore deposit</li> </ul>	<ul style="list-style-type: none"> <li>- Practical training for a coal gasification analysis using simultaneous thermogravimetric analyzer</li> <li>- Preparation for a publication of the practical training result</li> <li>- Preparation work for the amendment of manuals and textbook in relation to analyzer</li> <li>- Model lecture for the oxidation of coal</li> </ul>

### 9th Short-term Training in Mozambique

#### Lecturers and Coordinators

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi (MMTEC)

#### Final Seminar and Model Lecture in Mozambique, 2019

Training Item/Schedule		Content
Mozambique (10th Training)	11/11~15/11	Hold JCC and Final Seminar of this Project

### 10th Short-term Training in Mozambique

#### Lecturers and Coordinators

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi (MMTEC)

The above training was conducted once a year in Japan and twice a year in Mozambique. The actual training was conducted using the equipment provided by this Project, which is shown in the next section.



Practical Training for Separation of Zircon from Rock  
using Donated Stereomicroscope in UEM



Practical Training for Reaction Rate Analysis of Coal Samples using Donated Simultaneous Differential Thermogravimetric Analyzer in ISPT

## 5. Donated Equipment

The equipment to be provided was selected according to the actual situation in the baseline survey conducted at the beginning of the project. For the UEM, the equipment was used for preparation for geoscience analysis and pre-analysis for geological surveys. On the other hand, for the ISPT, the equipment for proximate analysis leading to the analysis of coal was selected.

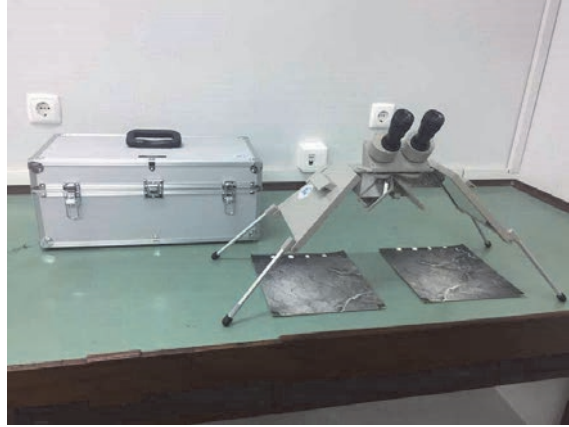
The donated equipment for UEM and ISPT are as follows.

### ➤ Donated Equipment to UEM

- Stereo Microscope (NIKON SMZ1270)
- Mirror Stereoscope (TOPCON SOKKIA MS27 and MS16)
- Constant temperature Oven (YAMATO DVS602)
- Electronic Muffle Furnace (SHIMADZU RIKA MPL310P)
- Electronic Scale (SHIMADZU RIKA AUW220, UW420H and UW1020H)
- Chemical Apparatus



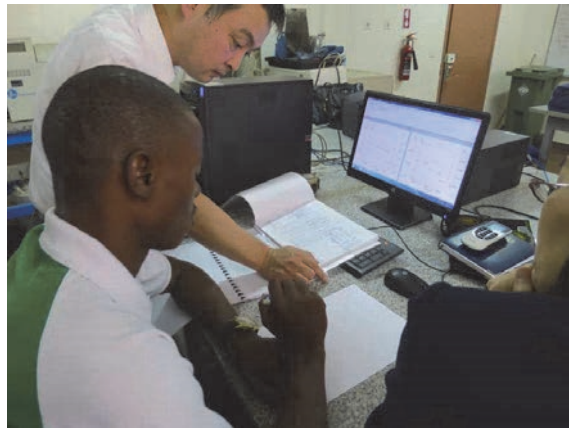
Stereo Microscope (NIKON SMZ1270)



Mirror Stereoscope (TOPCON SOKKIA MS27 and MS16)

➤ Donated Equipment to ISPT

- Simultaneous Differential Thermogravimetric Analyzer (SHIMADZU DTG-60)



Simultaneous Differential Thermogravimetric Analyzer (SHIMADZU DTG-60)

6. Preparation of Management and Operation Manuals for the Donated Equipment

Since 2016, practical training on management and operation of the equipment related to the provision of equipment has been conducted in the short-term training conducted in Mozambique and Japan, and the procedure manuals have been prepared by the trainees as part of the results in this Project. The created procedure manuals are as follows, and the created procedure manuals can be used as a textbook for student experiments handled by teachers in both universities.

① Mineral Analysis (for UEM)

- "Manual for Creating Thin Section"
- "Manual for Use of X-ray Diffraction Testing Equipment"
- "Manual for Zircon Separation from Rock Sample"
- "Manual for Analysis of Zircon with Scanning Electron Microscope (SEM)"

② Coal Analysis (for ISPT)

- "Manual for Utilization of the Simultaneous Differential Thermogravimetric Analyzer"
- "Maintenance Manual for the Simultaneous Differential Thermogravimetric Analyzer"
- "Troubleshooting Manual for the Simultaneous Differential Thermogravimetric Analyzer"

#### 7. Preparation of Guidance Textbook for Curriculum

In addition to the above procedure manuals for using the equipment, the trainees also prepared a textbook for student guidance including the basic skills of handlings for related instruments obtained in the trainings. The title of this textbook is as follow.

- "Chemical Analysis of Coal Produced in Mozambique"

The contents of this textbook consist of titration analysis which is the basis of element analysis, atomic absorption spectrometry and ICP analysis, which enable simultaneous analysis of multiple components. This textbook was created as a part of teaching students on coal analysis. Currently, UEM and ISPT are preparing to revise the student guidance curriculum. Therefore, this textbook will be included as a lecture with the same name in the revised curriculum at ISPT.

#### 8. Achievements and Challenges by Trainings in this Project

Training items, achievements and challenges, which were conducted for the UEM and ISPT, are summarized as follows.

Achievements and Challenges based on this Training (UEM)

Action items	Outcome	Issue
Method for preparation of rock thin section and ore polish	<ul style="list-style-type: none"> <li>• The methods of a maintenance and management for the materials involved in the preparation were learned.</li> <li>• The preparation has been routinized, and the order for preparation has been accepted from the external organization.</li> </ul>	<ul style="list-style-type: none"> <li>• Maintenance and management require constant supply of consumables to be prepared. → To schedule the budget applications to relevant organization.</li> </ul>
Methods of observing and identifying rocks and minerals	<ul style="list-style-type: none"> <li>• The observation and identification method by using the X-ray diffractometer was learned, and the same procedure was fed back in the university on handling and identification method of the instrument.</li> </ul>	<ul style="list-style-type: none"> <li>• In order to operate and maintain the X-ray diffractometer, it is necessary to understand the basis of the instrument and the method of operation, and to establish the operation and maintenance management system on the UEM own.</li> <li>• X-ray handling supervisor is required. → To apply for the acquisition budget after confirming that the operation and maintenance management system can be</li> </ul>

		established after understanding the instrument in the UEM.
Method of mineral separation for the dating	<ul style="list-style-type: none"> <li>In addition to the availability of donated equipment, methods for the separation of zircon from rocks and the maintenance of materials and equipment were obtained, and the technique of separation were routinized in the laboratory of the UEM.</li> </ul>	<ul style="list-style-type: none"> <li>It is necessary to become recognized the accuracy of zircon separation by related organization of outside, which need to maintain a routine method in the UEM. <ul style="list-style-type: none"> <li>→ To publicize the methods to outside the university.</li> <li>→ To perform collaborative research on zircon dating and research using zircon, which will be conducted in linkage with the research conducted by teachers abroad.</li> </ul> </li> <li>In order to maintain the routines, it is necessary to always supply consumables related to the separation. <ul style="list-style-type: none"> <li>→ To apply to relevant organization for budget of the maintenance.</li> </ul> </li> </ul>
Method of geological mapping for mineral resources	<ul style="list-style-type: none"> <li>Mapping methods specializing in mineral and energy resources were learned rather than basic geological mapping.</li> </ul>	<ul style="list-style-type: none"> <li>There are few professional teachers in this field of general education of mineral resources. <ul style="list-style-type: none"> <li>→ To feed back the research on mineral resources into the university through a joint research by teachers studying abroad or through international studies.</li> </ul> </li> </ul>
Method of geological remote sensing survey for coal resources and of calculating mineral resources volume	<ul style="list-style-type: none"> <li>Trainees were learned how to interpret coal resources using satellite images and the donated equipment for interpretation by using aerial photographs, and how to calculate the mineral resources volume for coal resources using the interpretation.</li> </ul>	<ul style="list-style-type: none"> <li>There are few professional teachers in the education field of coal and energy resources. <ul style="list-style-type: none"> <li>→ To feed back the research on coal and energy resources into university by international joint researches through the study abroad of teachers.</li> </ul> </li> </ul>

#### Achievements and Challenges based on this Training (ISPT)

Action items	Outcome	Issue
Method for proximate analysis and evaluation of coal using the Simultaneous Differential Thermogravimetric Analyzer	<ul style="list-style-type: none"> <li>Analyzer was donated and installed, and operating and maintenance methods of the devices were learned.</li> <li>The repeatability of the measurement was confirmed and the continuous usage became possible.</li> <li>Instructions have been given to students using the analyzer.</li> <li>The basis of the coal evaluation method by analyzer was learned.</li> </ul>	<ul style="list-style-type: none"> <li>In the future, it is necessary to carry out the evaluation of coal characteristics through continuing analysis of various kinds of coal samples by their own. <ul style="list-style-type: none"> <li>→ To gain experiences in analysis and evaluation in relation to coal through study abroad and joint research with Japanese universities.</li> <li>→ To link between research contents conducted by the study abroad for teachers and skills for</li> </ul> </li> </ul>

		the analysis and interpretation for the purpose of improving the accuracy of analysis and evaluation as well as experience.
Method of titration analysis and related analysis	<ul style="list-style-type: none"> <li>Analytical theories and methods were learned.</li> <li>Textbook on the method was prepared and ready to provide lectures to students.</li> </ul>	<ul style="list-style-type: none"> <li>This analysis is a necessary item for the future education and research to proceed to the next stage. Therefore, the learned analytical methods need to be performed within the ISPT by their own.</li> <li>→ To try to perform the titration analysis in ISPT by using relevant materials which is available in Mozambique.</li> <li>→ To apply a budget for the acquisition of high performance analytical instruments on the multi-component analysis, when the operation and maintenance management system of the instruments can be established.</li> </ul>
Method of coal gasification characteristics analysis and interpretation	<ul style="list-style-type: none"> <li>Methods of interpreting the characteristics of coals including coal occurred in Tete were learned by using the donated analyzer.</li> <li>The results of analysis and interpretation are now being published in papers and other publications, and the presence of research capabilities in ISPT will be increased in the future.</li> </ul>	<ul style="list-style-type: none"> <li>ISPT needs to make analyses and prepare papers by own.</li> <li>→ To continue to publish papers through international joint researches with overseas universities to link the research conducted by teachers studying abroad.</li> </ul>
Method of geological mapping for coal resources	<ul style="list-style-type: none"> <li>Method of geological mapping specific to coal resources rather than basic mapping and method of interpretation for coal resources at the geological outcrop including actual coal were learned.</li> </ul>	<ul style="list-style-type: none"> <li>In terms of student education, there are few teachers in geology, and the curriculum is also necessary to consider revision in the current situation.</li> <li>→ To feed back the research on coal and energy resources into university by international joint researches through the study abroad of teachers.</li> <li>Establishment and maintenance of basic materials and equipment related to the preparation and observation using rock thin section and ore polish are required.</li> <li>→ To procure and install the equipment through applying a budget for the equipment, when it became possible to establish an operational and maintenance system in ISPT.</li> </ul>

## 9. Recommendation for the Future

Based on current situations in UEM and ISPT, the items that both universities should be carried out independently in the future based on the present situation are summarized as follows.

### 1) UEM

- To continue to maintain and manage the rock, mineral and chemical laboratory which were enhanced in this project.
- To establish external presence in the field of geology through publication of the results of trainings in this project (enhancement of methods for mineral separation within university, etc.)
- To activate and continue of overseas joint research in the fields of geology, mineralogy, and geophysics, to which current teachers have been studying abroad
- To select and secure experimental equipment to be installed in the future based on joint research with overseas universities
- To activate and continue appeals for the significance of related education and research for an acquisition of the budget on the equipment installation.
- To collaborate with teachers in UEM, who have studied abroad through "Kizauna Program" in Japan
- To cooperate with related organizations such as MIREME

### 2) ISPT

- To continue the maintenance and management of the newly installed Simultaneous Differential Thermogravimetric Analyzer by the Chemical Laboratory
- To establish an external presence in the coal energy field by publishing the results of trainings (about the coal gasification characteristics for occurrence in Tete by using donated analyzer)
- To activate and continue overseas joint research, to which current teachers study abroad, in the fields of coal energy, coal cleaning and mining field, etc.
- To select and secure experimental instrument that needs to be installed in the future based on related basic education and research
- To activate and continue appeals for the significance of related education and research for an acquisition of the budget on the equipment installation.
- To collaborate with teachers in ISPT, who have studied abroad through "Kizauna Program" in Japan
- To cooperate with related organizations such as MIREME

## CHAPTER 1 Preface

### 1.1 Background

Republic of Mozambique (hereinafter referred to as Mozambique) gained independence from Portugal in 1975. Then, the country erupted into a civil war that continued for 16 years. During that time, democratization didn't proceed smoothly and the country fell into a vicious cycle of poverty and conflict, which resulted in the economic stagnation. Although a low economic growth continued after the end of the civil war in 1992, the country have sustained the annual economic growth of 6% to 10% over the past few years, a high level of growth compared to the other countries in the world. While Mozambique still has many development challenges internally, enormous potential in the resources area has been confirmed in recent years, which attracts international attention.

Among many resources, recently, the development, mainly the coking coal development in Tete Province and natural gas development in the Rovuma gas field off the coast of Palma located in Cabo Delgado Province, has been making progress with the private companies as a main entity. Japan enterprise also possesses the part interest and takes part in development. Among them, coal originally produced in Tete had exported after being transported by existing railways via Beira Port in central Mozambique. However, there are restrictions on transportation capacity to Beira Port, and the completion of construction of rail and port infrastructure via Nakala Port has led to the enhancement of transportation capacity. On the other hand, regarding metal mineral resources that have not yet been developed on a large scale at present, the potential of titanium and zircon contained in heavy sand, and rare metals associated with carbonatite and pegmatite has been confirmed, and the potential for future development is expected.

Though the above development is currently being promoted under the initiative of foreign companies, the knowledge and capacity of promotion and management for the development by government organizations in Mozambique are lacking, because large-scale development has not been carried out until now in Mozambique. In Mozambique, peripheral infrastructure, regional development, and legislation have not progressed. This situation is arising issues and challenges in promoting natural resource development. In this way, the training and human resource development capabilities in the domestic resource sector are currently low, and in addition, there is a shortage of domestic engineers in this area. Meanwhile, human resources in large foreign-owned enterprises such as Vale, which is developing coal in Tete, are secured through in-house training of engineers and procurement of engineers from abroad. Consequently, resource development has not necessarily led to the capacity development of relevant personnel in Mozambique and the expansion of general employment. Therefore, the human resource development for government, academic, and private sectors in the area of mineral resources in Mozambique is considered essential to contribute to the sustainable development and management of mineral resources that realize economic growth in the country.

Under these circumstances, Ministry of Mineral Resources, Mozambique (MIREM) requested the technical cooperation for capability strengthening that focuses on the human resource development of



government institutions, universities, and research institutions in the field of resources. Then, survey for developing detailed plan was conducted in March 2014, and R/D (Record of Discussions) was signed in June 2014.

## 1.2 Purpose of this Project

The purpose of this Project is to improve the organizations of the educational institutions for the promotion of sustainable mineral resources development and raise the educational level of special undergraduate courses to the international standard by improving structures and environment at Universidade Eduardo Mondlane (UEM) and Instituto Superior Politécnico de Tete (ISPT) for effectual experiments and practical training including geological and mineralogical observations and chemical analysis.

## 1.3 Implementation Structure of this Project

### 1.3.1 Concerning Agency of Mozambique

Educational Institutions : Universidade Eduardo Mondlane (UEM) and Instituto Superior Politécnico de Tete (ISPT) and

Governmental Agency : Ministry of Mineral Resources and Energy (MIREME)

### 1.3.2 Implementation Structure of this Project

The implementation structure is as shown in Figure 1.3-1. The consultant conducted the overall survey and operation. The detailed examination and contents of research and education were supported and provided direction by the Faculty of International Resource Sciences and the Faculty of Engineering Science of Akita University, Japan.

The implementation personnel of the above structure are as follows.

#### (1) Akita University

##### 1) Graduate School of International Resource Sciences

- Dr. Akira Imai, Professor (Petrology, Mineralogy and Economic Geology) \* Current position: Kyushu University
- Dr. Ryohei Takahashi, Associate Professor (Petrology, Mineralogy and Economic Geology)

##### 2) Graduate School of Engineering Science

- Dr. Katsuyasu Sugawara, Professor (Chemical Engineering, Chemical Reaction Engineering, Energy)
- Dr. Takahiro Kato, Lecturer (Catalyst/Resource Chemical Process)

#### (2) Organization of Counterpart

##### 1) MIREME

- Mr. Antonio Eugenio Manda (Director, Directorate of Planning and Cooperation)
- Mr. Eugenio Simbine (Former Director, Directorate of Planning and Cooperation)

- Ms. Catia Manjate (Head, International Cooperation Section, Directorate of Planning and Cooperation)
- Mr. Francisco Luis Junior (Directorate of Planning and Cooperation)
- Mr. Mahoque Luis Alberto (Higher Technician, Directorate of Planning and Cooperation)

2) UEM

- Dr. Elidio Massuanganhe (Head, Department of Geology)
- Dr. Estevao Inacio Sumburane (Former Head, Department of Geology)
- Dr. Daud Liace Jamal (Associate Professor)
- Dr. Luis A. Magaia (Lecturer)
- Mr. Sergio Ezequiel Goenha (Manager, Laboratory)

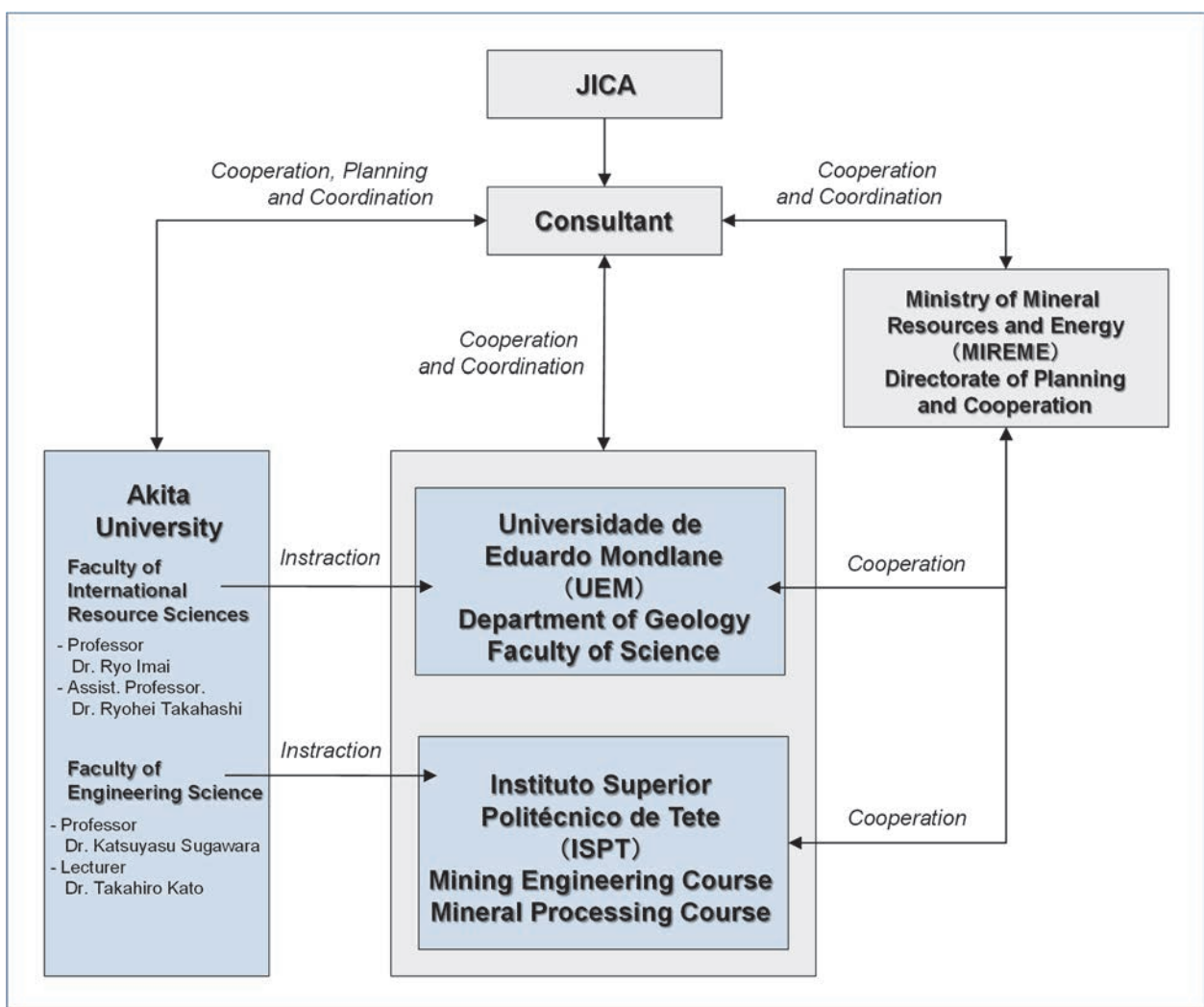


Figure 1.3-1 Implementation Structure of this Project

3) ISPT

- Dr. Bernardo Miguel Bene (Director General)
- Mr. Romualdo Brito (Vice General)

- Mr. Neves Semente Jemuca (Director, Mining Engineering Course)
- Mr. Antonio Onofre (Director, Center for Scientific Investigation of Technical Resources and Technologies)
- Mr. Gilberto Rogaciano Goba Sabonete (Chief, professional Practice Department)
- Mr. Rimua Albuquerque Leonardo (Manager, Chemical Laboratory)

(3) Consultant

- Japan Coal Energy Center
- Mitsubishi Materials Techno Corporation

### 1.3.3 Members Engaged in the Operations and Their Task Responsibilities

The members of consultant engaged in the operations in this project are as shown below.

(1) Phase 1

- Leader, mine development, soil analysis,  
and human resource development 1 person
- Higher technical education 1 person
- Coal development and coal analysis 1 person
- Equipment planning 1 person
- Coal technologies and resources education 2 persons
- Human resource development and resources education 1 person

The 7 members are engaged in the operations.  
Their task responsibilities are described below.

Table 1.3-1 Task Responsibilities of Each Engaged Persons in this Project (Phase 1)

Name	Responsibility	Content of Responsibility
Koichi Tanaka	Leade, Mine Development and Geological Analysis	- Overall supervision - Organization of JCC and TC - Communication and coordination with C/P organization
Yoshimitsu Negishi	Higher Technical Education	- Preparation and organization of Short-term training - Creation of curriculums of universities - Creation of practical training manuals for equipment
Toyokazu Sugawara	Coal Development and Coal Analysis A	- Field training in Short-term training - Compilation of reports - Support to Long-term Training
Kinuko Matsunaga	Equipment Planning	- Selection of equipment to be donated - Creation of equipment maintenance manuals - Procurement of equipment
Masafumi Uehara	Coal Technologies and Resource Education	- Preparation and organization of coal policy training - Creation of curriculum of coal policy training
Satoru Kushida	Coal Technologies and Resource Education	- Preparation and organization of coal policy training - Creation of curriculum of coal policy training
Junko Saito	Human Resources and Resource Education	- Preparation and organization of coal policy training - Creation of curriculum of coal policy training - Interviews with trainees and information collection of Mozambique

(2) Phase 2

- Leader, mine development, soil analysis,  
and human resource development 1 person
- Higher technical education 1 person
- Coal development and coal analysis 1 person
- Equipment planning 1 person
- Coal technologies and resources education 1 person
- Human resource development and resources education 1 person
- Interpreter 1 person

The 7 members are engaged in the operations.  
 Their task responsibilities are described below.

Table 1.3-2 Task Responsibilities of Each Engaged Persons in this Project (Phase 2)

Name	Responsibility	Content of Responsibility
Koichi Tanaka	Leade, Mine Development and Geological Analysis	- Overall supervision - Organization of JCC and TC - Communication and coordination with C/P organization
Yoshimitsu Negishi	Higher Technical Education	- Preparation and organization of Short-term training - Creation of curriculums of universities - Creation of practical training manuals for equipment
Masafumi Uehara	Coal Development and Coal Analysis A	- Preparation and organization of coal policy training - Preparation and organization of coal analysis training
Shusaku Miyaike	Equipment Planning	- Selection of equipment to be donated - Creation of equipment maintenance manuals - Procurement of equipment
Satoru Kushida	Coal Technologies and Resource Education	- Preparation and organization of coal policy training - Creation of curriculum of coal policy training
Junko Saito	Human Resources and Resource Education	- Preparation and organization of coal policy training - Creation of curriculum of coal policy training - Interviews with trainees and information collection of Mozambique
Kyoko Tamai	Interpreter	- Interpretation at JCC and TC - Interpretation during Short-term training - Councination and coordination wirh C/P organizations

## CHAPTER 2 Details of Support for Both Universities

### 2.1 Baseline Survey

#### 2.1.1 Schedule of Survey

The baseline survey was conducted between 23 May and 7 June, 2015, after the commencement of the Phase 1. The purpose of this survey was conducted to understand the actual situations for both universities.

Schedule of Survey is shown on Table 2.1-1.

Table 2.1-1 Schedule of Survey and Corresponding Person (23 May to 31 May, 2015)

Date	Day of Week	Visit	Interview	Visitor	Stay	
5/23	Sat.	Tokyo→Hong Kong	-	-	Hong Kong	
5/24	Sun.	Hong Kong→	-	-	flying overnight	
5/25	Mon.	→Johannesburg→Maputo JICA Mozambique Office	-	-	Maputo	
5/26	Tues.	Ministry of Mineral Resources and Energy (MIREME) Directorate of Planning and Cooperation, Directorate of Human Resources Development, National Directorate of Mines, Institute of Geology and Mines	Mr.Francisco Luis Junior (Directorate of Planning and Cooperation), Mr.Luis Mahdque (Higher Technician of Directorate of Planning and Cooperation), Ms.Haila Pleodo (Representative of Directorate of Human Resources Development), Dr.Daud Liace Jamal (Deputy General Director of Institute of Geology and Mines), Mr.Salazar Mangumo (Mining Engineer of Institute of Geology and Mines)	Tanaka(JCOAL), Negishi(MMTEC), Aoki(JICA), Victorino (JICA)	Maputo	
		Eduardo Mondlane University (UEM) Department of Geology, Faculty of Science	Dr.Estevão Sumburane (Head of Department of Geology), Dr.Orozco Geraldo (Professor), Dr.Musaa Achimo (Lectuer), Mr.Sergio Gooenha (Laboratory Manager)			
		Embassy of Japan in Mozambique	-			
5/27	Wed.	Deutsche Gesellschaft Fur Internationale Zusammenarbeit (GIZ)	Mr.Peter Wolf (Head of Program), Ms.Gieda Loforte (person in charge of Human Resources)	Tanaka(JCOAL), Negishi(MMTEC), Aoki(JICA)	Maputo	
		Library of UEM	Librarian of Library			Tanaka(JCOAL), Negishi(MMTEC)
		Ministry of Science and Technology, Higher Education and Vocational Training	Dr.(Ms.) Sandra L. Estrela Brito (Nartional Director), Ms.Loaila Darulao (Financial Department)			Tanaka(JCOAL), Negishi(MMTEC), Aoki(JICA)
5/28	Thur.	Mozambican Exploration Mining Company (EMEM)	Ms.Inocência Maculuve (Deputy General Director), Dr.Daud Liace Jamal (Deputy General Director)	Tanaka(JCOAL), Negishi(MMTEC)	Maputo	
		Institute of Geology and Mines (IGM)	Mr.Casimiro Francisco (Chairman of the Board and CEO), Mr.António Manhiça (Chief Technical and Operational Officer), Ms.Mónca Mata (Chief Financial Officer)			
5/29	Fri.	Joint Coordination Committee (JCC)	(Participants) MIREME: Mr.Francisco Luis Junior (Directorate of Planning and Cooperation) UEM: Dr.Estevão Sumburane (Head of Department of Geology) ISPPT: Dr.Bernardo Miguel Bene (Director General) Embassy of Japan in Mozambique: Mr.Ito (First Secretary) JICA Mozambique Office: Ms.Morita (Deputy Representative), Mr.Aoki (Assistant Representative), Mr.Simões Victorino (Program Officer) Consultant: Tanaka (JCOAL), Negishi (MMTEC) and Ms.Abe (Interpreter and Coordinator)	Tanaka(JCOAL), Negishi(MMTEC), Aoki(JICA)	Maputo	
		MIREME Directorate of Study and Projects	Mr.António Manda (Deputy Director)			
5/30	Sat.	-	-	-	Maputo	
5/31	Sun.	Maputo→Tete	-	-	Tete	

Table 2.1-1 Schedule of Survey and Corresponding Person (1 June to 7 June, 2015)

Date	Day of Week	Visit	Interview	Visitor	Stay
6/1	Mon.	Tete Provincial Directorate of Mineral resources and Energy	Mr.Manuel José Sithole (Director), Mr.Armindo Chinai Saide (Inspector)	Tanaka(JCOAL), Negishi(MMTEC)	Tete
		Instituto Superior Politécnico de Tete (ISPT)	Dr.Bernardo Miguel Bebe (Director General) Mr.Antonio Owofoe (Head of Center for Scientific Investigation of Technical Resources and Technologies), Mr.Neves Semente Jemuca (Director of Mining Engineering Course)	Tanaka(JCOAL), Sugawara(JCOAL), Negishi(MMTEC), Matsunaga(MMTEC)	
6/2	Tues.	Revuboe Project	Revuboe鉱山: Mr.Victor Thompson (Senior Camp Manager), Mr.Nel Mondlane (Exploration and Mining Geologist) Nippon Steel & Sumitomo Metal: Mr.Sato Nippon Steel & Sumikin Bussan: Mr.Ohkawa	Tanaka(JCOAL), Sugawara(JCOAL), Negishi(MMTEC), Matsunaga(MMTEC)	Tete
6/3	Wed.	Instituto Superior Politécnico de Tete (ISPT)	Dr.Bernardo Miguel Bebe (Director General) Mr.Antonio Owofoe (Head of Center for Scientific Investigation of Technical Resources and Technologies), Mr.Neves Semente Jemuca (Director of Mining Engineering Course)	Tanaka(JCOAL), Sugawara(JCOAL), Negishi(MMTEC), Matsunaga(MMTEC)	Maputo
		Instituto Medio de Geologia e Minas de Moatize	Mr.Ramiro Recibo Macajo (Deputy Diretor General)		
		Tete→Maputo	-	-	
6/4	Thur.	UEM Department of Geology, Faculty of Science	Dr.Estevão Sumburane (Head of Department of Geology), Mr. Eduardo Siquela (Professor)	Tanaka(JCOAL), Sugawara(JCOAL), Negishi(MMTEC), Matsunaga(MMTEC)	Maputo
		Vale S.A. Office in Maputo	Mr.Luke Thomas Mahony (General Manager:Resources Development and Continuous improvement Department), Ms.Luciana Faria, Ms.Lwezi Serodio (Recrutimnt Selection & regional Education Africa Human Resources)	Tanaka(JCOAL), Sugawara(JCOAL), Negishi(MMTEC), Matsunaga(MMTEC)	
		Representative Office of Mitsui Co. Europe Plc. in Maputo		Aoki(JICA)	
6/5	Fri.	Ministry of Mineral Resources & Energy	Mr.Benjamin Chilenge (Director)	Tanaka(JCOAL), Sugawara(JCOAL), Negishi(MMTEC), Matsunaga(MMTEC) Aoki(JICA)	Maputo
		JICA Mozambique Office	-	-	
6/6	Sat.	Maputo→Johannesburg→	-	-	flying overnight
6/7	Sun.	→Hong Kong→Tokyo	-	-	

## 2.1.2 Inspection for Both Universities

### (1) Universidad Eduardo Mondlane (UEM)

Actual situations of activities for the education and the research on the relevant area of mineral resources in UEM at the baseline survey of Phase 1 on May, 2015.

#### (a) Overview

- Founded in 1962, renamed to UEM in 1968. Faculties include the Faculty of Literature, Law, Economics, Science, Engineering, Agriculture, Medicine, and Veterinary Medicine. The Geology Department falls under the Faculty of Science. Approximately 35,000 students are enrolled (Photo 2.1-1).

#### (b) Related Departments (Geology Department, Faculty of Science)

- No. of Faculty/Staff: 23 (8 PhD Holders, 2-3 College Graduates, 5 acquiring their PhDs, 2 acquiring their MA's)
- Where PhDs were Acquired: Are currently 5 PhD holders (Kyoto University (1), Uppsala University and Stockholm University in Sweden (3), Norwegian University of Science and Technology (1))
- Faculty Fields of Expertise: Sedimentology, Stones and Minerals, Petroleum Geology, Coal Geology, Geophysics, Mining (Scheduled to have an expert from Sweden for Geophysics)

- No. of Students: Approx. 200 (Four-year × 50 students, Graduate × 40 students (The Graduate Master's Program was established 2 years ago), planning to establish a Doctorate Program within the next 2 years)
- Courses: 4 Courses (Geology, Coastal Environment, Mineral Resources Management, Petroleum)
- Department Budget: USD15,000/p.a. (Budget request to the Ministry of Finance)
- Employment for Graduates: Government-affiliated organizations (Mineral Resources, Environment, Water Resources, Energy), Vale, Jindal, Rio Tinto, Gondwana, Chinese enterprises, Eni.



Photo 2.1-1 Entrance of Geology Department, Faculty of Science, UEM (left) and Collecting Information at UEM (right)

(c) Classes/Research (Geology Department)

- Curriculum: Field studies (inspection tour including actual geological surveys) will be conducted once per annum (July), with 3 to 4 instructors for approximately 15 students, along with Master Program students. (Budget from the Ministry of Finance, entrepreneurial support to cover Master's students' participation fee may apply)
- Field Training: Training is included in the curriculum. Training is a geological survey, but considered a part of ones Bachelor' s and/or Master' s thesis. Conducted once per annum (July) over the period of a few weeks. 3 to 4 instructors will train approximately 15 students, and Master's students will also participate (Budget from the Ministry of Finance. Entrepreneurial support to cover Master's students' participation fee may apply). Targeted geological features are sedimentary rock and gneiss, and recently the training has been held in the Manica province. For access to the field, a mini-bus donated by the ENRC is used.
- Research: Currently conducting a research based on the field studies conducted in the above mentioned field training, and the joint research with Stockholm University. No research related to coal or petroleum is currently being conducted. Would eventually like to conduct exploratory research on regional geological studies and mineral resource development such as coal. At this time, an instructor will be sent abroad to study (PhD), and reports based on the joint research conducted will support the on-campus research.
- Original Field Research Opportunities: Once per annum during the field training, and this original field research is the theme for ones Bachelor' s and/or Master' s thesis. The instructors' main job is to



conduct a university class, and in reality the only opportunity for the instructor to conduct his or her own original research is during the field training.

- Joint Research: SIDA (Swedish International Development Cooperation) Research on stratigraphy and sedimentology with Stockholm University (Research on carbonate rock and coastal environment by mutual interactions between teachers and exchange students are being conducted in the Beira region).
- Laboratories and Facilities: Rock Preparation Laboratory (thin section making area), Sedimentology Laboratory, Microscope Observation Room, Geological Analysis Room (area with analyzing software), Rock and Mineral Storage Room, Library (Photo 2.1-2).
- Laboratory Technicians: There are instructors coordinating the technicians, and technicians managing the apparatuses in the laboratory. However, the only apparatus to manage is the microscope; therefore currently, the duties of a technician are scarce to none.



Photo 2.1-2 Practical Training for Microscope Observation to Student (left) and Library of Geology Department (right)

(d) Aid (Geology Department)

- Aid: Human resource capacity development was conducted by the Netherlands, and recently renovations on campus facilities have been done by the ENRC in Kazakhstan (Eurasian Natural Resources Corporation PLC); educational aid by SIDA through seminars, studying abroad, joint research, etc.; and Petrel, a petroleum geology analysis software provided by JICA and Eni.
- Equipment Aid: Recently, only the donation of a polarizing microscope and petroleum geology analysis software.

(e) Library Condition

- UEM Library (Main Campus)

The library on the main campus was renovated in 2008 with the support of the World Bank, and Chinese contractors constructed the facilities. The library is currently in its 2nd phase of renovations, expanding with the increase of books and updates made to the database system (Photo 2.1-3).



Photo 2.1-3 Library of Main Campus (left) and the Inside (right)

With the management of the main library, no matter the faculty or department, all books bought by the university, past Bachelor’s/Master’s theses, scientific journals etc., are registered and added to the database. The Geology Department (Faculty of Science) is not on the main campus, and the department also has its own separate library. Books and theses first always go through the main library and registered in the database, therefore even if numerous campuses are apart with their own libraries, all materials of the university can be found using the search system. All books that can be found in branch libraries are first registered at the main library, however in these situations, another copy of the same book is bought and stored at the main library.

The library search system can be accessed once applied for. We used this search system with the aid of the librarian. For the search, we chose the word “Coal”, and found no results. However when we directly went to the Earth Science section of the library, we found numerous books that should have appeared as a result in the database search. According to the librarian, the database is still being developed (Photo 2 4).

Using the same search system, we looked for an online scientific journal, and for geology, “The Geological Society” appeared as a result. Including this journal, theses can also be read if are registered.

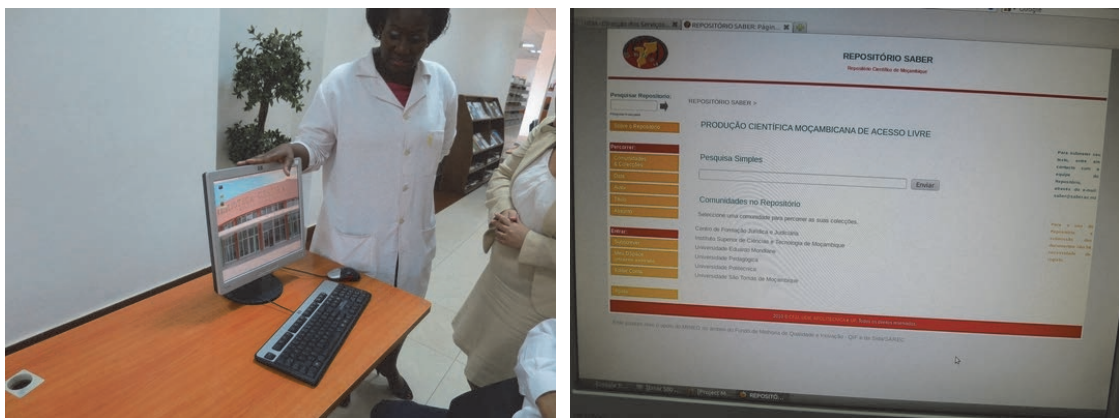


Photo 2.1-4 Search System for Library (left) and Display of the System (right)

- UEM Geology Department Library, Faculty of Science

The Geology Departments’ library is within the same building of the department, and general scientific books and journals can be found. All new books and scientific journals purchased for the department are first registered at the main library, and then taken to the Faculty of Science and Engineering campus. However, for materials already stored at the library do not seem to be completely registered on the search system database yet (Photo 2.1-5).



Photo 2.1-5 Inside of Library of Geology Department:  
Storage Situation for Graduation Thesis (left) and for Bibliotheca (right)

Books and materials can generally be found on the shelves in an organized manner, however considering that although the materials are registered at the main library, and very few geological terms could be found using the search system, there is still a need to organize the registering process (Photo 2.1-6).



Photo 2.1-6 Graduation Thesis in Library of Geology Department,  
UEM (left) and Doctoral Thesis (right)

(f) Concerns and Requests

Concerns and requests from UEM during this baseline survey in UEM were as follows.

1) Concerns

- Due to limited budgets, classes (experiments) and research are not being fully conducted. The Ministry of Finance allots the budget among different universities. This allocation is not based on the performance of each university.

- Students are recruited by enterprises before graduating. However, in many cases due to corporate downsizing, these students return to university at some point.

## 2) Requests

- General: Wish to know and discuss the content of short-term training curricula; Have mutual exchanges with instructors through long-term training (each party conducts a presentation for the other); Know the content of the research that can be done through studying abroad, such as with Akita University.

- Equipment: Petrographic microscopes (For students and for instructors), thin section maker, precision balance, coal analyzing apparatus (later send priority list).

## (g) Project Direction

Items to need consideration on implementations for the provision of equipment and the trainings in this project based on the result of baseline survey in UEM on May 2015 are as follows.

- The level of knowledge of the instructors is sufficient with no notable issues (holding undergraduate lectures). On the other hand, the laboratories, which are the base of any research, are not sufficiently equipped. Even the Microscope Observation Room is not in order. These factors are a part of what can obstruct ones' private research.
- To invigorate research activities, the feedback produced by the joint studies, based on the research done by PhD students studying abroad, is considered to be important.
- It would be ideal to have equipment based on future research themes, however for the time being what is being requested, microscopes, thin section maker, and precision balance are adequate. Also, procuring equipment to improve the quality of training in the field is being considered.
- For the short-term training in Japan, a comparative review of laboratory conditions, and lecture content differences in Japan and the UEM are to be conducted. Through these comparisons, both parties need to be able to identify what UEM requires, and determine a future course of action as well as training content.

## (2) Instituto Superior Politécnico de Tete (ISPT)

Actual situations of activities for the education and the research on the relevant area of mineral resources in ISPT at the baseline survey of Phase 1 on June, 2015.

### (a) Overview

- Founded in 2005. Departments include Mineral Processing, Mining Engineering, Computer Engineering, and Business Administration. Out of the total 1,600 students enrolled, 700 students study Mineral Processing and Mining Engineering. The campus was relocated to its current location in 2011. At

the time the institute was founded in 2005, the largest planned number of students was at 10,000. Therefore the campus is vast, and along with the number of students, facilities are currently being expanded even further (Photo 2.1-7).



Photo 2.1-7 School building of ISPT (left) and Situation of Lecture to Student (right)

(b) Related Departments (Mineral Processing, Mining Engineering)

- No. of Faculty/Staff: 32 (2 PhD Holders, 4 MA Holders, and college graduates) Scheduling and conducting measures for instructors with no degree to acquire MA's and/or PhD's.
- Where PhD's/MA's were Acquired: Hokkaido University (1), Wits University in South Africa (3), Federal University of Rio Grande de Sul and Federal University of Ouro Preto (8), University of Sao Paulo (1).
- Faculty Fields of Expertise: All professors specialize in Mining (mining, geology, processing)
- No. of Students: Approx. 700 (Four-year with two month of field work for first year and internship for the other 3 academic years), no Graduate School.
- Department Budget: Unknown (Same as UEM, budget request to the Ministry of Finance)
- Employment for Graduates: Mainly organizations in the coal industry, with no current lack of job opportunities. Most students work in the coal industry at enterprises in the Tete province. Also students work for government-affiliated organizations (Mineral Resources, Energy). Most of the students in Mineral Processing and Mining Engineering departments are employed at the local Vale Company (Moatize Mine), ISPT, Knmare Moma Mining, International Coal Venture Private Limited (ICVL), .Syrah Resource (Graphite of Balama-Cabo Delgado Province) and JINDAL.

(c) Classes/Research (Mineral Processing and Mining Engineering)

- Curriculum: Conducting lectures on mine planning, mining, processing, and basic geology. A textbook for students exists (in Portuguese), however the content is still being improved. The professors use and make their own material for lectures. There is no field study included in the curriculum, but a 1-year corporate internship program (2 months at a time, 4 times throughout the year). Therefore, students are enrolled for a total period of 4 years.
- Research: Currently as a part of the corporate internships and by request from enterprises, research is related to Mine Planning (mining landfill design, measurements of access roads, optimization of cyclone

separators, etc.). Most of the professors are currently acquiring their degrees, therefore the research is mainly based on the needs of the corporations.

- Original Field Research Opportunities: Currently one of the professors is studying at Hokkaido University, and as research material for the university, the professor brought 5kg of coal to Japan. The current reality is that there is no other specific research being conducted.
- Joint Research: As mentioned above, there is no current joint research being conducted as of this time.
- Laboratories and Facilities: Mineral Preparation Room, Chemical Laboratory, PC Training Room, Library.
- Laboratory Technicians: There is a supervising instructor.

(d) Library Condition

The ISPT library is on campus. The library covers all courses, however the books and materials on the shelves in the reading room are limited, and the layout of the shelves and desks is cluttered, with few people using the library at all. There are also a few computers (Photo 2.1-8).



Photo 2.1-8 Library of ISPT (left) and the Reading Room (right)

In the far end of the library facility, are the stored books and materials. It is a very narrow area next to the reading room, and the shelves are next to the walls and in the middle of room, therefore there is room for one person to walk between the shelves. Theses of past graduate students are also stored in piles (Photo 2.1-9, Figure 2.1-1).

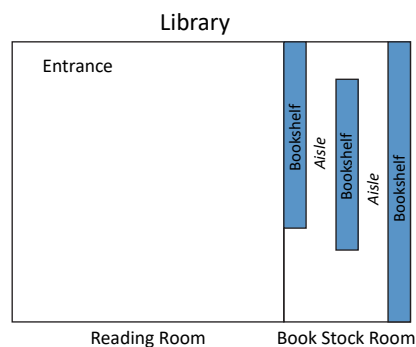


Figure 2.1-1 Layout of the Library



Photo 2.1-9 Inside of the Library (left) and the Book Shelf (right)

Theses consist of approximately 50 pages on A4 size paper in ring-files, with a table of content, table of figures, and the actual content (Photo 2.1-10(left)). The content is in Portuguese. The themes of the theses are practical, based on the requests made by nearby active mines such as appropriate route designs for exclusive roads, and research on appropriate placement designs for transporting and accumulating dirt within mines (Photo 2.1-10(right)).

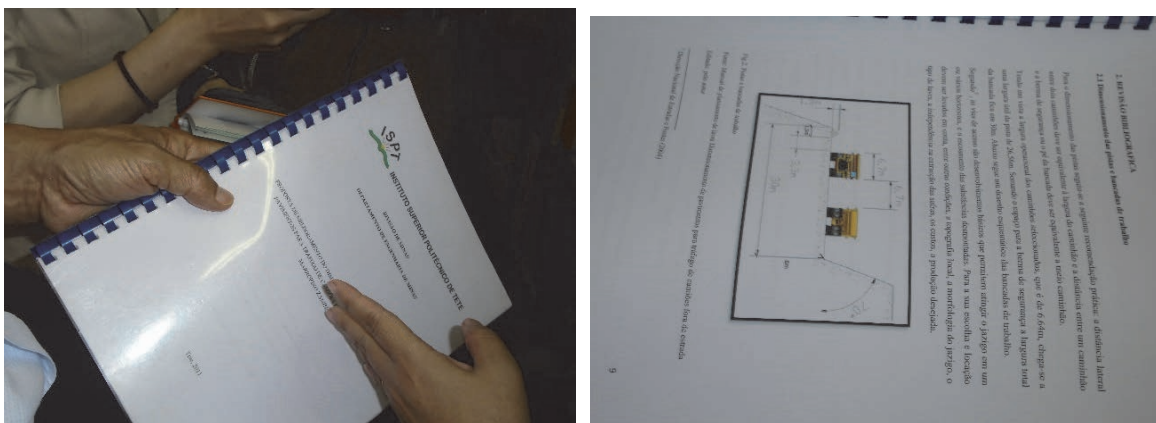


Photo 2.1-10 Graduation Thesis of ISPT (left) and the Content (right)

In the same area as the stored books, there is a machine for registering bar-codes. Although there is a need to bar-code and manage the books, many are yet to be registered, and the management system that exists is inadequate (Photo 2.1-11(left)). Many books and materials are in boxes (over 10 boxes); therefore there are many technical books that cannot be accessed (Photo 2.1-11 (right)). Maps are laminated, therefore are rolled up and stored on an empty shelf side by side.



Photo 2.1-11 Registration Equipment by Bar-Code (left) and Unfiled Specialized Books (right)

The technical books in the reading area are mainly in English, and are classified by their specific fields (Photo 2.1-12 and Photo 2.1-13).



Photo 2.1-12 Library in the Reading Room, which consists of General Geology, Human Engineering and Coal Processing (left) and Topography and Mineral Processing (right)



Photo 2.1-13 Library in the Reading Room, which consists of Mineralogy and Electric Engineering (left) and Metallogeny (right)



(e) Aid (Mining Related)

- Aid: Donations of equipment for coal analysis by Nuffic, the Netherlands organization for international cooperation (equipment costs at approximately US\$1 million, covered by the government and Nuffic), and the establishment of the Master's program by Vale's Technological Institute of Brasil. Included in the aid provided by Nuffic, the costs to send the professors to study abroad is included. The details of the aid provided by Vale is to dispatch instructors from the University of Sao Paulo, Federal University of Rio Grande de Sul and Vale's Technological Institute to Tete province, to help professors and Vale employees acquire their MA's.

- Equipment Aid: Donations of equipment for coal analysis by Nuffic in 2014. The equipment was transported and installed by the South African company, LABOTEC. However the equipment is in operation. Training by Nuffic on analyzing the data, and training by LABOTEC was done, but for operation of ISPT is still waiting for teachers who are finishing there MA and PhD.

(f) Concerns and Requests

Concerns and requests from ISPT during this baseline survey in ISPT were as follows.

1) Concerns

- The university is young, and the professors still need to expand their capacities, therefore studying abroad and acquisition of degrees are recommended. Those professors that study abroad will need to give feedback to the university on what they have learned.
- Enterprises recruit students before graduation, leading to students dropping out (Same issue as UEM).

2) Requests

- General: Wish to know and discuss the content of short-term training curricula. Materials used for lectures are still being created, therefore would like to receive support in the creation of lecture textbooks. The manual for using the coal analysis equipment is also being created, and as of now, there is no knowhow on using the equipment.
- Wish to give feedback and conduct research based on what professors learn during long-term training. At this time would like there to be mutual interaction with the instructors.
- With both short and long-term training, the department focuses on training Mining Engineers, however in Japan the focus is more towards geological research. At ISPT, would also like to conduct more research on themes such as coal geology.
- Equipment: In need of equipment to substitute the current coal analysis equipment.

(g) Project Direction

Items to need consideration on implementations for the provision of equipment and the trainings in this project based on the result of baseline survey in ISPT on June 2015 are as follows.

- The basic knowledge of instructors (holding undergraduate lectures) is unknown. However considering that materials for lectures are still being created, and that most of

the instructors are currently studying abroad, once an examination of the curriculum is conducted, there is a high probability that assistance will be needed to create appropriate textbooks.

- The coal analysis equipment was donated to better equip the laboratory, however considering that it is still not in use yet. There is a high probability that assistance will be needed to create manuals to use the analysis equipment.
- There is a need to reevaluate the current training content, and decide a course of action after conducting an inspection of coal analyzing facilities during the short-term training in Japan.
- For the content of training, there is an interest towards the coal processing conducted at Hokkaido University, and also geology, therefore coal seam evaluation is also a considered as a possibility.

### 2.1.3 Ministry of Mineral Resources, Other Donors

Current support in this field of study, for both universities

- Support for UEM: Epi, SIDA, ENRC
- Support for ISPT: Vale, Nuffic
- Support for the general mining sector: World Bank, German International Cooperation Organization (GIZ)
- Advice by the Mozambique Ministry of Science and Technology (Former Ministry of Education) to the Ministry of Finance on preferential budgets in the Resources Field

### 2.1.4 Demand for Human Resource Development in the Field of Mining Development

#### (1) Graduated Universities of Current Engineers in Fields such as Geology and Natural Resources

- For both government and private sector engineers, many graduated from UEM. In the coal industry, most graduated from UEM and ISPT.
- In the fields of petroleum and natural gasses, a budget increase for the Lurio University has been requested. Considering the lack of engineers in the field, there is a possibility that there will be an increase in employment from the same university.

#### (2) Demand for Engineers in Fields such as Geology and Natural Resources

- There is a constant need for more engineers in the fields of coal and natural gasses. In the fields of mining and geology, there are many specialized fields that exist; therefore many enterprises have a high demand.
- Currently there is no lack of employment opportunities for UEM and ISPT, actually creating the problem where students dropout of university due to enterprises offering them employment before graduation.

### (3) Basic stance in the mineral resource field in EMEM

According to a statement by Chairman of the Board of Directors of Casimiro Francisco (dated 29 May 2015) published in the local newspaper MOZEFOPais, the Government approved the "Mineral Resources Human Resources Development Strategy" as an effort to achieve the human resources development for its own citizens. The Government has set a budget of \$138 million, with the goal of cultivating a total of 4220 engineers both domestically and internationally from 2010 to 2020. As part of the strategy, a number of students were already dispatched to Malaysia and merged with those who had been sent to Malaysia before the strategy was formulated. In addition to Malaysia, Mozambique students are learning about an oil engineering in countries such as the Netherlands, Norway, and Angola.

Another urgent issue is securing crushed stones for construction at the beginning of the LNG project, and it is said that approximately 150,000 tons of crushed stones will be required in eight months of the first phase of the LNG project. However, in the 2015 Economic and Social Plan (PES), the domestic crushed stone production volume is estimated to be approximately 1.8 million tons, and the situation must be said to be extremely tight. Under these circumstances, contractors and some subcontractors are requesting to the government about the import from abroad. Since 2014, EMEM has been examining the ways to improve the capacity of private sectors in Mozambique to address this challenge. They are encouraging specialists to identify quarry sites and to conduct investigation on the quality of crushed stone at the sites.

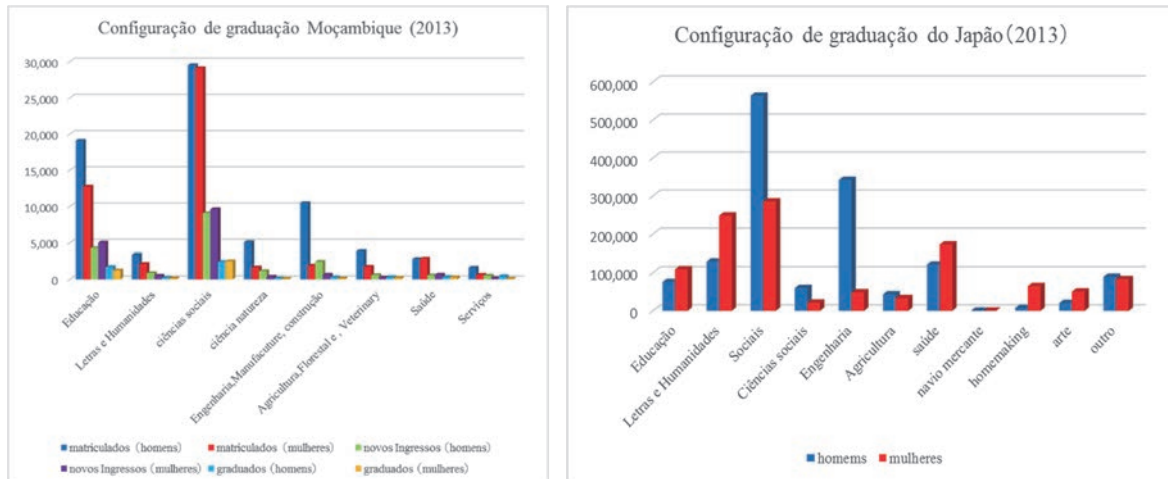
#### 2.1.5 Other Information

##### (1) Comparison in Number of Students by Department in Universities in Mozambique and Japan

Based on the documents obtained during the visit to the Ministry of Science and Technology, we report the comparison in number of students by department in Mozambique and Japan as below.

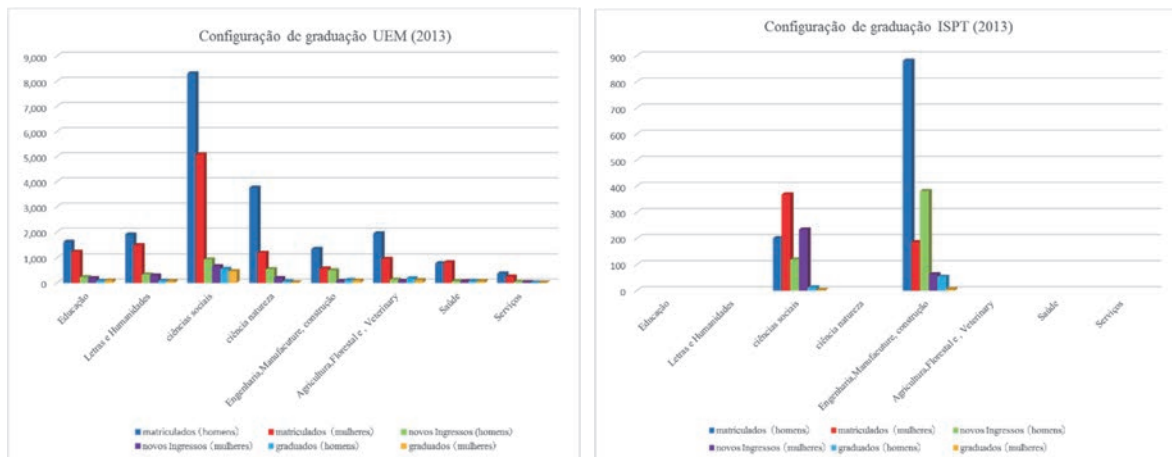
The result of comparison in number of students by department in Mozambique and Japan based on the documents of Ministry of Science and Technology in Mozambique and related information in Japan is shown in Figure 2.1-2.

In Mozambique, the number of students in the fields of education and social science is high. On the other hand, Japan has more students in the fields of social science and engineering. The composition of the departments in UEM and ISPT reflects the characteristics of the universities; one is a comprehensive university and the other is an engineering university (Figure 2.1-3).



Source: Statistical data in Mozambique from the Ministry of Education and data from the Statistic Bureau, the Ministry of Internal Affairs and Communications (Japan)

Figure 2.1-2 Number of Students by Department in Universities in Mozambique (left) and Japan (right)



Source: Statistical data in Mozambique from the Ministry of Education and data from the Statistic Bureau

Figure 2.1-3 Number of Students by Department at UEM (left) and ISPT (right)

### 2.1.6 Plan for Selection of Equipment to Donate and Content of Training

Based on the results of the above-mentioned baseline surveys and other information, the state of educational environment and support in the UEM and ISPT related to the area of mineral resources, the state of related administrative agencies and industries in Mozambique, and the needs for universities from companies and so on, the selection of equipment and materials to be donated and the formulation of training contents were carried out as follows.

#### (1) Selection of Equipment to Donate

The selection of the equipment to donate was carried out during the baseline survey in Phase 1 and the Short-term Training in Japan and Mozambique. In the selection of the equipment, the actual infrastructure of both universities and the availability of related materials were taken into consideration, and the

selected equipment and materials were considered to be independently maintained and managed by both universities even after the completion of this project.

The situation leading to the selection of equipment based on the baseline survey is as follows.

(a) Donated Equipment to UEM

The only functioning equipment are the microscopes, therefore presumably no experiments are being conducted at the UEM on the May 2015. Analyses for research are apparently being subcontracted to South Africa, but with budget and quantity limitations, this is a great hinder to the research. Based on this situation, items for the provision of equipment will be targeted to be used effectively for practical trainings and research activities, which will be installed at preparation rooms and laboratories in the UEM.

To repair the equipment in the Rock Preparation Laboratory for use, they need to be sent to the manufacturer to first receive a quote. There is a possibility that the discoplan can be used once repaired. The rock cutters and grinders were installed in 1965, and the rotating areas are worn down to the point where paying to repair them would be impractical. For some of the equipment in the Sedimentology Laboratory, there is a possibility they can be repaired by only replacing a few components such as the adapters.

The equipment donated by SIDA is the basic equipment needed for geological surveys and research. Among these, X-ray diffractometer basically belongs to a portable instrument, which is sufficient to follow the manufacture's procedure manual when using this equipment. Therefore, this equipment has a complementary role using this kind of basic equipment.

Considering the aforementioned circumstances and plans, equipment such as chemical analyzers need to be installed. However even if UEM was to acquire large machinery, they do not believe they are capable of properly handling them. Therefore, based on the current situation, it was evaluated that stereo microscope, electronic analytical scale, constant temperature oven, and so on as the equipment to donate are suited for preparations of interpretation and chemical analysis in relation to geological researches. This kind of equipment are not complicated. However, it will become beneficial when used with the equipment provided by SIDA, which can be linking basic research to advanced research.

Among these, the stereo microscope is intended to be used for the zircon separation during the U-Pb zircon dating analysis preparation process. Measurements of the geological age for rocks by using U-Pb dating is an extremely important for determining the geological age of rocks in Mozambique. A geological dating in the present state in Mozambique is being carried out in overseas research institutes from the stage of the preparation. If this preparation can be carried out by UEM, it would be very beneficial, for example, to shorten the period of traveling abroad related to the dating and to reduce the cost of shipping samples from Mozambique to overseas.

(b) Donated Equipment to ISPT

The existing equipment in ISPT is experimental equipment such as analytical equipment provided and delivered in 2013 including CHN analyzer which can conduct elemental analyses such as analyses of carbon and sulfur with the content order of several 10%. Therefore, it was considered to provide equipment that complements the analyzer assuming its use. However, it was became clear in baseline survey that restructurings of linkage with other equipment are needed to conduct analyses by using these equipment and materials (Photo 2.1-14).

Based on the current condition at the laboratory in ISPT, it was decided that there is a need to prepare an environment to conduct basic proximate analyses (for ash content, volatile component, water content) before settings up the environment of elemental analyses. According these considerations, a simultaneous differential thermogravimetric analyzer that can be used alone and is relatively easy to handle was selected as an equipment to donate. In this concept, it will be able to establish the proximate analysis in the first stage and the elemental analysis if possible in the second stage in the future, which ISPT should try to enhance their capacity of this area based on the trainings by using the equipment. After these process, ISPT will become the only university/research institution to have the capability of conducting proximate and elemental analyses in Mozambique.



Photo 2.1-14 Muffle Furnaces and Cupellation Furnace (left) and Draft (right)

(2) Planning of Training

The planning for contents of the Short-term Trainings was carried out during the baseline survey and the Short-term Training in Phase 1, as well as the above-mentioned selection of equipment to donate. The training was conducted based on the current status and needs of both universities, which were collected by the baseline survey and the Short-term Training in Japan and Mozambique during Phase 1. The contents of the training were planned including a utilization of the equipment to be donated to both universities. The training was divided into the Short-term Training in Japan and Mozambique, and the training was made consideration to be a content that can be learned gradually from basic to application.

The situations leading to the planning of training contents based on information obtained from the baseline survey are as follows.

(a) Training Items for UEM

Selected equipment for UEM as above will be used for preparation of the chemical analysis and pre-interpretation of the geological survey. The equipment are composed of microscope, stereoscope, electric furnace and so on which are not complicated instruments. However, the equipment are positioned as a vital instrument for a bridge-building between basic and constructive research in the terrain. Therefore, the method of education and research using the equipment will be also included in the training, in addition to the content of method for utilizing and maintaining of equipment.

Training plan is created in consideration of the above, the basic training items for the UEM in the current situation are as follows:

- i) How to prepare rock and mineral section
- ii) Method of rock and mineral observation and identification using polarization microscope and reflecting microscope
- iii) Method of mineral separation
- iv) Method of aerial photograph interpretation
- v) Method of field geological survey
- vi) Method of geological mapping

(b) Training Items for ISPT

Equipment for ISPT was selected on the basis of destination which the laboratory in ISPT will be carried out proximate analysis underlying basis of coal evaluation. At that time, ISPT needs the know-how for the handling and maintenance of the selected equipment. Therefore, the content related to the basics of proximate analysis and equipment, method for utilizing and maintaining of equipment, and accuracy of assay and analysis are included in the training.

Additionally in 2013, several experimental equipment for chemical analysis were delivered to ISPT by the aid of Nuffic and World Bank, and by the budgets from the government. However current ISPT have not fully used these equipment yet. Varieties and quantities of the donated and delivered equipment at ISPT seem sufficient. On the other hand, it seems to need effective learnings for the settings of the equipment and the methods of research, analysis and evaluation by using the equipment.

Training plan is created in consideration of the above, the basic training items for the ISPT in the current situation are as follows:

- i) Basics of analysis in respect to coal evaluation
- ii) Method for proximate and element analysis
- iii) Method for utilization of analysis data

## 2.2 Donated Equipment

### 2.2.1 Contents of Donated Equipment

The equipment to be provided was selected during the baseline survey in the Phase 1 and during short-term training in Japan and Mozambique, which were conducted in 2015. The reasons for the selection of equipment are as described in the above Section 2.1.

The donated equipment for both universities are as follows.

#### (1) Donated Equipment for UEM

Procured and installed equipment are as follows:

Table 2.2-1 Procured and Installed Equipment in UEM

No.	Description	Quantity
1	Stereo microscope	
	SMZ1270 (SMZ1270TERG-DSL32-POL)	1
	SMZ1270 (SMZ1270TERG-PS32)	1
2	Accessories for the stereo microscope	
	Episcopic illuminator, Polarizing Set and Digital Camera Adapter Set	1
3	Mirror stereoscope	
	SOKKIA MS27	1
	SOKKIA MS16	14
4	Laboratory constant temperature ovens	
	YAMATO DVS602	2
5	Electronic muffle furnace	
	SHIMADZU MPN-310P	2
6	Electronic analytical scale	
	SHIMADZU AUW220	3
	SHIMADZU UW420H	3
	SHIMADZU UW1020H	3
7	Chemistry apparatus	
	Lakeside Cement NICHKA LC-12	2
	Canada Balsam	10
	Accessories for Probe box TC-1	2
	Stainless steel trays	20
	Scoops (square type)	4
	Scoops (small)	4
	Spoon	10
	Spatulas	10
	Tweezers	5
	Wash bottles	10





Photo 2.2-1 Stereo Microscope (trinocular scope), Illumination Device and Digital Camera  
(Nikon SMZ1270 TRG-DSL32-POL)



Photo 2.2-2 Stereo Microscope (binocular scope) and Illumination Device  
(Nikon SMZ1270 TRG-PS32)



Photo 2.2-3 Oven: 2 sets (SHIMAZU DVS602)



Photo 2.2-4 Electronic Muffle Furnace: 2 sets  
(YAMATO MPN-310P)



Photo 2.2-5 Electronic Analytical Scale: 2 sets (SHIMADZU AUW220)

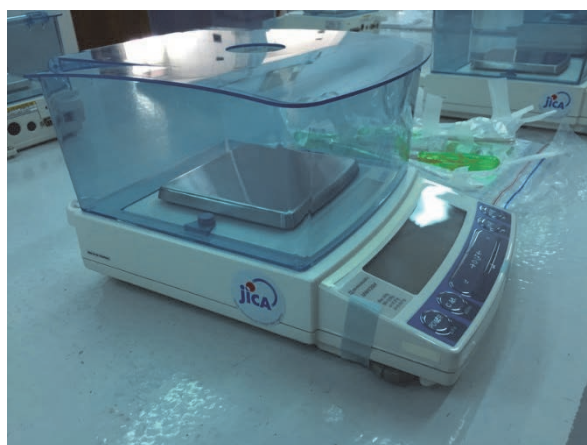


Photo 2.2-6 Electronic Analytical Scale: 3 sets (SHIMADZU UW420H)

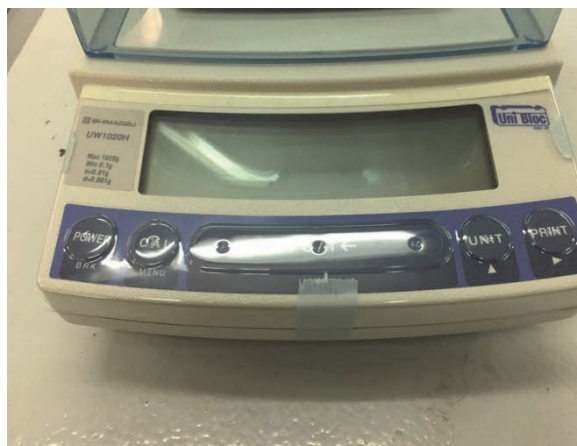


Photo 2.2-7 Electronic Analytical Scale: 3 sets (SHIMADZU UW1020H)



Photo 2.2-8 Lakeside Cement (24 pieces, 2 sets)



Photo 2.2-9 Canada Balsam (10 bottles)



Photo 2.2-10 Storing Container for bottles  
(20 cases)



Photo 2.2-11 Stainless Steel Trays  
(20 cases)



Photo 2.2-12 Scoops: Square Type (4 sets)



Photo 2.2-13 Scoops: Small Type (4 sets)



Photo 2.2-14 Spoon: Normal Type (5 sets)



Photo 2.2-15 Spoon: with Spatula (5 sets)



Photo 2.2-16 Spatula (5 sets)



Photo 2.2-17 Tweezer: Particularity Type (5 sets)



Photo 2.2-18 Wash Bottle (10 pieces)

(2) Donated Equipment for ISPT

Selected and procured equipment are as follows:

Table 2.2-4 Selected and Procured Equipment in ISPT

No.	Description	Quantity
	Simultaneous Thermogravimetry/Differential Thermal Analyzers (DTG-60)	
i	Main unit of the DTG-60	1
ii	Control hardware (TA-60WS)	1
iii	Atmosphere control part (FC-60A)	1
iv	Decompression part (for N <sub>2</sub> )	1
v	Conduit tube for carrier gas (5m)	1
vi	Sample cell for Pt	10



Photo 2.2-19 Simultaneous Differential Thermogravimetric Analyzer (SHIMADZU DTG-60)



Photo 2.2-20 Control Hardware (SHIMADZU TA-60WS)



Photo 2.2-21 Atmosphere Control Part (SHIMADZU FC-60A)



Photo 2.2-22 Decompression Part for N<sub>2</sub>



Photo 2.2-23 Conduit Tube for Carrier Gas (5m)



Photo 2.2-24 Sample Cell for Pt (6 φ x 2.5)

## 2.2.2 Procurement and Installation of Donated Equipment

The equipment was selected and procured in the Phase 1, and was procured based on the specifications and quantities of the plan. Procurement was conducted in accordance with the procurement rules of JICA, and the procured equipment was transported and installed at UEM and ISPT. Selection of the equipment was carried out from Phase 1 and the actual procurement procedure was commenced on April 2016 after the contract of Phase 2 between JICA and consultant. Selection of the dealer and order were performed in the May based on the procurement procedure and the procedure of equipment preparation and export was completed in July. The shipment was finally carried out at the beginning of August 2016.

## 2.3 Implementation of the Short term training in Mozambique and Japan

Plans for the content of trainings were performed during the baseline survey in the Phase 1 and during short-term training in Japan and Mozambique, which were conducted in 2015. The background and details of the plan formulation are as described in the Section 2.1.

Among these plan, the trainings in the Phase 1 mainly consist of lectures and tours related to geological research and coal utilization research. On the other hand, the trainings in the Phase 2 were implemented in stages from basic to applied according to the equipment selected in the Phase 1 and the training contents for three years from 2016 to 2019.

The actual situation of trainings at both universities is as follows.

### 2.3.1 Training for the Universidade Eduardo Mondlane (UEM)

Training is divided into the short-term training conducted at the UEM in Mozambique, and at Akita University and related universities and institutions in Japan. The contents of these trainings are as follows for each year.

(1) Phase 1

(a) 2015

In 2015, three training sessions were held in May to June and November to December in UEM, and October in Japan (Table 2.3-1).

Table 2.3-1 Training for the UEM, 2015

Training Item/Schedule		Content
Mozambique (1st Training)	25/5~5/6	- Baseline Inspection (gather information of experimental materials, curriculum, laboratory, skills and so on.)
Japan (1st Training)	4/10~24/10	- Visit to related universities, research institutions, and private enterprises in Japan
Mozambique (2nd Training)	30/11~11/12	- Final selection of equipment to donate - Model lectures for mineralogy, coal analysis, and geological mapping

#### Baseline Survey (1st Visit to Mozambique)

##### Participants

- Consultant: Koichi Tanaka, Toyokazu Sugawara (Japan Coal Energy Center, hereinafter JCOAL), Yoshimitsu Negishi, Kinuko Matsunaga (Mitsubishi Materials Techno Corporation, hereinafter MMTEC)

#### 1st Short-term Training in Japan

##### Trainees

- UEM: Dr. Estevao Inacio Sumburane, Dr. Daniel Luis Ibraimo, Mr. Sérgio Ezequiel Goenha

##### Lecturers

- Akita University: Professor Akira Imai, Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences), Professor Katsuyasu Sugawara, Lecturer Takahiro Kato (Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Toyokazu Sugawara, Junko Saito (JCOAL) Yoshimitsu Negishi (MMTEC)

#### 2nd Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Professor Akira Imai (Faculty of International Resource Sciences) Professor Katsuyasu Sugawara (Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Toyokazu Sugawara (JCOAL), Yoshimitsu Negishi (MMTEC)

The first short-term training from May to June was focused on the baseline survey. Information of the organization, number of students and teachers, budget status, academic degree acquisition status of teachers, research background, research databases owned by universities, and another information of

related faculty/department (curriculum, course information, etc.) as basic information of the UEM were collected.

Based on the collected information, further training, and selection/installation of equipment were planned.

In the short-term training in Japan held on October, education and research activities for the related fields in Japan were mainly inspected. Visiting destinations for the training course were Akita University, Hokkaido University, Kyoto University, National Institute of Advanced Industrial Science and Technology, Sanmi Coal Mine, Yufutsu Gas Field, Shimadzu Corporation, Kimitsu Steel Works, and Tomitsu Research Institute for the iron manufacture. In the Akita University, trainees visited laboratories, libraries and related facilities, and participated lectures (model classes) and received explanations about curriculums of Akita University. Additionally, they attended a practical training for making rock thin section, which was requested from them at the start of the project.



Photo 2.3-1 Visitation of Course work (left) and Experimental Facility (right) during Short-Term Training in Japan

The short-term training in UEM from November to December was focused on classroom lectures of geological mapping for explorations in relation to mineral resources such as coal and metals. At the same time, based on the results of the baseline survey in Mozambique on May and the short-term training in Japan on October, equipment such as stereomicroscope, stereoscope, drying oven, muffle furnace, electronic balance, and analytical preparation were selected as equipment provided for UEM.



(2) Phase 2

(a) 2016

In 2016, three training sessions were held in August to September and October to November in Mozambique and September to October in Japan (Table 2.3-2).

Table 2.3-2 Training for the UEM, 2016

Training Item/Schedule		Content
		UEM
Mozambique (3rd Training)	26/8~9/9	- Coordination for management and operation of the equipment - Model lecture of ore deposit
Japan (2nd Training)	26/9~21/10	- Practical training for preparation of rock thin section
Mozambique (4th Training)	31/10~11/11	- Coordination for management and operation of the equipment - Model lectures for ore deposit, and coal exploration technique by using remote sensing GIS

2nd Short-term Training in Japan

Trainees

- UEM: Mr. Terra Eugenio Gove

Lecturers

- Akita University: Professor Akira Imai, Assistant Professor Ryohei Takahashi  
(Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Masafumi Uehara, Junko Saito (JCOAL)  
Yoshimitsu Negishi (MMTEC)

3rd Short-term Training in Mozambique

Lecturers and Coordinators

- Akita University: Professor Akira Imai (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara (Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi (MMTEC)

4th Short-term Training in Mozambique

Lecturers and Coordinators

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara (Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi, Shusaku Miyaike (MMTEC)

During the short-term training in UEM from August to September, discussions on the procurement (import) and deployment of selected equipment were mainly held.

The installation site of equipment provided from Japan was checked together with the person in charge of equipment operation and management. Sites for the equipment are installed in the sedimentology laboratory, the microscope laboratory, and the geological analysis preparation room (Photo 2.3-2, 2.3-3, 2.3-4, and 2.3-5).

Installation equipment in each laboratory was designed as follows.

- Sedimentology Laboratory: 2 sets of Drying Oven, 2 sets of electric furnace, 3 sets of electronic balance (large), 3 sets of electronic balance (medium), 3 sets of electronic balance (small), and 1 set of materials for preparation of rock thin section
- Microscope Laboratory: 2 Nikon stereomicroscopes and 1 microscope camera system
- Geological Analysis Preparatory Room: 15 sets of SOKKIA reflecting stereoscope



Photo 2.3-2 Sedimentology Research Laboratory  
(planned place of installation for drying oven)



Photo 2.3-3 Sedimentology Research Laboratory  
(planned place of installation for balance)



Photo 2.3-4 Microscopic Laboratory  
(Installation place of stereomicroscope)



Photo 2.3-5 Geological Analysis Preparation Room  
(Installation place for reflecting stereoscope)

Management structure for the donated equipment are as follows.

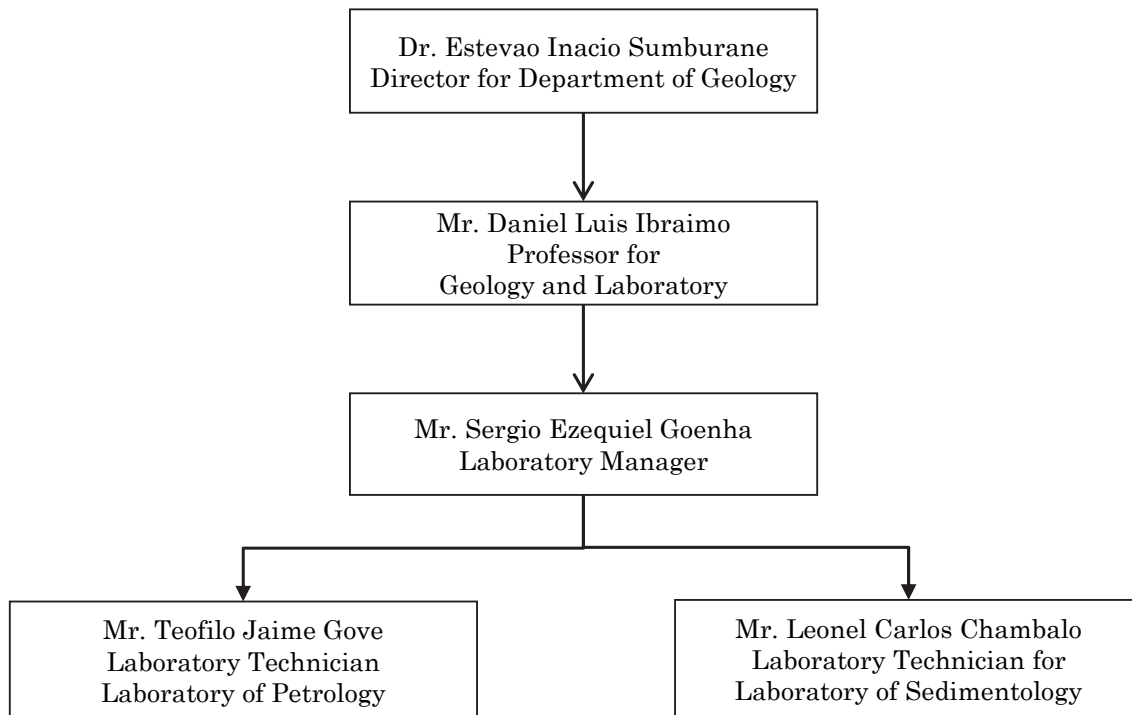


Figure 2.3-1 Management Structure for the Donated Equipment (UEM)

In the short-term training in Japan during September to October, preparation methods for preparation of the thin and polished section for rock and mineral observation was trained by professor in Akita University. Site for the training was within the Faculty of International Resource Sciences, Akita University. At the same time of the training, a procedure manual for the creation of thin section was prepared and it was made available for the creation in UEM. One trainee of the participants in this training was also visited education and research facilities and organizations in related fields in Japan, and it was decided to make reference to the future curriculum in UEM. Visiting destinations for the training course were Hokkaido University, Tokyo University, Kyoto University, Kyushu University, Sanmi Coal Mine, Shimadzu Corporation, Kimitsu Steel Works and Isogo Thermal Power Station.



Photo 2.3-6 Practical Training in the Preparation of Rock Thin Section and Mineral Polished Section during Short-term Training in Japan

During the short-term training in Mozambique from October to November, consideration and confirmation of installation site for the donated equipment were carried out as a part of the coordination about the management and operation for the equipment. The installation space of the donated equipment can be adequately secured by arranging the existing materials, and it was informed to arrange the space to secure the space before the delivery of the equipment from Japan.

At the same time, the installation status of the simple type X-ray diffractometer newly purchased by UEM and the storage status of the thin section making equipment donated by SIDA were also confirmed.



Photo 2.3-7 Installation Status of Newly Installed X-ray Powder Diffractometer  
(in the Department of Geology, UEM)



Rock Cutting Equipment



Discoplan



Polishing Machine for Rock and Ore



Polishing Liquid Circulation Tank for Rock and Ore

Photo 2.3-8 Condition of Storage for the Equipment Donated by SIDA  
(in the Department of Geology, UEM)



Photo 2.3-9 Condition of Rock Preparation and Chemistry Laboratory  
(in the Department of Geology, UEM)



Photo 2.3-10 Condition of Microscope Observation Room  
(in the Department of Geology, UEM)

In addition, investigation team inspected the geological field excursion route in suburbs of Maputo, where the field training for students of the Department of Geology is being conducted. In this inspection, the route of the survey point, the condition of geological outcrops and so on were confirmed with professor of UEM at the points, and the items to be added to the current curriculum were examined. The survey points are located at a distance of approximately one hour from the UEM by car, and the condition of outcrops is nice, and the topographical features of the geological structure can be observed very well. Therefore, it was confirmed that curriculums can be prepared by combining geological observations in the field and analysis in the laboratory of UEM in combination with the stereoscope provided in this project and thin section preparation equipment provided by the SIDA.



Photo 2.3-11 Inspection of the Geological Excursion Route for Students  
of the Department of Geology in UEM (near Maputo)

(b) 2017

Training in 2017 consisted of short-term training in Mozambique on May and October to November and the short-term training in Japan on July (Table 2.3-3).

Table 2.3-3 Training for the UEM, 2017

Training Item/Schedule		Content
		UEM
Mozambique (5th Training)	15/5~26/5	- Installation of the equipment and instruction for handling of the equipment - Model lectures for ore deposit, aerial photograph, and coal resource calculation
Japan (3rd Training)	3/7~28/7	- Practical training of X-ray diffractometer
Mozambique (6th Training)	30/10~10/11	- Instruction for handling of the equipment - Discussion of curriculum - Model lecture for hydrothermal deposit

### 3rd Short-term Training in Japan

#### Trainees

- UEM: Dr. Estevao Inacio Sumburane, Mr. Sergio Ezequiel Goenha

#### Lecturers

- Akita University: Professor Akira Imai, Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences), Professor Katsuyasu Sugawara, Lecturer Takahiro Kato (Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Masafumi Uehara, Junko Saito (JCOAL), Shusaku Miyaike (MMTEC)

### 5th Short-term Training in Mozambique

#### Lecturers and Coordinators

- Akita University: Professor Akira Imai (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara (Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Shusaku Miyaike (MMTEC)

### 6th Short-term Training in Mozambique

#### Lecturers and Coordinators

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara (Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Shusaku Miyaike (MMTEC)

During the short-term training in Mozambique on May, stereomicroscopes were assembled and installed, and other equipment was also installed. Practice runs were also performed on all donated equipment to confirm the normal operation. Additionally, the handling method for the each equipment were instructed to the teachers and technical officials in charge.



Photo 2.3-12 Stereomicroscope Assembly and Instruction



Photo 2.3-13 Status of Handling Instruction for the Electric Muffle Furnace



Photo 2.3-14 Status of Handling Instruction for Electronic Precision Balance



Photo 2.3-15 Status of Installation for the Donated Equipment

During the short-term training in Japan on July, training for the X-ray diffraction study was carried out in order to learn the identification method of rock and mineral based on the request from UEM. The training was implemented at the Faculty of International Resource Sciences, Akita University. As a background, a



simplified X-ray diffraction equipment was introduced in UEM on 2016, and the operation method of the equipment is similar to the identification process and the result by using usual system. Therefore, this practical training was conducted to compare the simplified measurement in UEM with the ordinary measurement at the short-term training in Japan, and it was decided to improve the measurement and identification knowledge in rock and mineral identification.

One of the participants in this training was also visited education and research facilities and organizations in related fields in Japan, and it was decided to make reference to the future curriculum in UEM. Visiting destinations for the training course were Hokkaido University, Kyoto University, Kyushu University, Sanmi Coal Mine, Shimadzu Corporation, Higashidani Limestone Mine, Kyushu Cement Plant, Kimitsu Steel Works, and Isogo Thermal Power Station.



Photo 2.3-16 Practical Training for X-ray Diffraction Measurement in Japan

In the short-term training in Mozambique on November, confirmation of the installation and the operation status of the donated equipment was mainly carried out. Among them, in the chemical laboratory, it was confirmed that the student have been carrying out the process of extracting clay minerals from the rock sample by using the donated equipment as a preparation for analysis. After this preparation process, the X-ray diffraction measurement, which was the training theme for the short-term training in Japan in this fiscal year, was carried out, and it was confirmed that the support by the donated equipment and the short-term training in Japan was utilized.

On the other hand, the construction of rock laboratory roofs was not completed the installation of preparation equipment for rock thin section donated by SIDA, and equipment could not be installed at present. However, the electrical wiring work seemed to have been completed, and the installation was scheduled to be carried out within this November.



Photo 2.3-17 Student Experiment using Donated Equipment  
(left: clay mineral separation, right: donated electronic balance)



Photo 2.3-18 Usage Condition of Donated Equipment; Oven (for drying of separated clay minerals)

It was confirmed that the equipment related to the interpretation of aerial photographs (reflective stereoscope) was used as the student practical training in the lecture of the photographic geology in the curriculum of UEM.

This lecture consists of a total of 80 hours, and the theory is 8 to 10 hours, and the other remaining time is a practical training using a reflection stereoscope. As a teaching material in this lecture, aerial photographs taken in Mozambique as general textbooks have been using for the practice of geological interpretation.



Photo 2.3-19 Condition of Student Training using Donated Equipment

(c) 2018

In 2018, three training sessions were held in May and November as short-term trainings in Mozambique and in October as in Japan (Table 2.3-4).

Table 2.3-4 Training Schedule for the UEM, 2018

Training Item/Schedule		Content
		UEM
Mozambique (7th Training)	28/5~5/6	- Instruction for handling of equipment creating thin section - Consideration of curriculum
Japan (4th Training)	1/10~26/10	- Practical training for separation of zircon and the interpretation - Training for mineral identification
Mozambique (8th Training)	19/11~30/11	- Practical training for separation of zircon - Consideration of curriculum - Model lecture for ore deposit

#### 4th Short-term Training in Japan

##### Trainees

- UEM: Mr. Hernani Vitorino Nhatinombe, Mr. Sergio Ezequiel Goenha

##### Lecturers

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Masafumi Uehara, Junko Saito (JCOAL)  
Yoshimitsu Negishi (MMTEC)

#### 7th Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)

Professor Katsuyasu Sugawara (Faculty of Engineering Science)

- Consultant: Koichi Tanaka (JCOAL), Shusaku Miyaike (MMTEC)

#### 8th Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)
- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi (MMTEC)

At the local training in May, equipment for the preparation of rock thin section donated by SIDA to UEM was installed, and it was confirmed that the equipment was normally used in student experiments (Photo 2.3-20). The equipment was donated in 2016 and then stored in the UEM, but the actual installation of these equipment were delayed due to the rehabilitation of the rock laboratory room where it will be installed. The installed equipment are as follows.

- ① Joe Crusher (made by HERZOG): 1 unit
- ② Ball mill (made by HERZOG): 1 unit
- ③ Large rock cutting machine (made by HERZOG): 1 unit
- ④ Rock cutting machine (made by Struers): 1 unit
- ⑤ Rock polishing machine (made by Struers): 2 units
- ⑥ Polishing plate and other consumables: 1 set



Photo 2.3-20 SIDA Donated Equipment and the Condition of Thin Section under Preparation (as a training for student)

In addition to the above, it was confirmed that the abnormal alarm was activated in the DVS-602 of the constant temperature drying oven (made by Yamato Scientific) among the equipment supplied to the UEM. When the set value of the equipment was checked, it was found that the wrong numerical value was input in two items, which were the temperature correction and the alarm set temperature. After correcting these values to appropriate values, trial runs for the oven were carried out, and it was confirmed that there were no abnormalities in the equipment.

The reason for this was considered to be that the rate of temperature increase was erroneously entered to two items of the correction temperature at the time of input by technicians, and the alarm setting temperature when the rate of temperature increase was set. For this reason, we instructed again the procedure for setting the rate of temperature increase, the standard for selecting the alarm set temperature, and whether or not there is a need for temperature correction.

The short-term training in Japan on October was carried out at the Faculty of International Resource Sciences of Akita University, and the practical training of zircon separation from rock for the purpose of age measurement of rock and the analytical practical training of X-ray diffraction measurement for the purpose of rock and mineral identification were carried out. Among these, the practical training for X-ray diffraction measurement was also conducted in 2017. Additionally, it was also learned the mineral identification and analysis method during this training. Through this practical training, procedure manuals of the zircon separation method and the rock and mineral identification method by X-ray diffraction measurement were performed.



Photo 2.3-21 Practical Training of Zircon Separation Method at the Short-term Training in Japan

In the short-term training in Mozambique on November, practical training for zircon separation work was carried out. Regarding zircon separation, instruction based on the contents of practical training at Akita University on October was performed by using materials in UEM on a trial basis. The sample for separation was a granite originated in Mozambique collected by Professor Sumburane. Materials that were necessary for separation but could not be secured in the UEM were an iron mortar for rock crushing, Nd strong magnets, and heavy liquid and centrifuge separator for mineral sorting. Although zircon can be separated efficiently by using these materials, it was not used in this training (Photos 2.3-22 and 2.3-23). Other consumables such as double-stick tape and vaseline were procured locally at a shop in Maputo. Donated drying oven and stereomicroscope were used for the separation of zircon. Especially, stereomicroscopes were useful for improving the accuracy of separation (Photo 2.3-24).

Ultimately, zircon was separated by their trial and error in UEM, and polished section was prepared for observation and analysis (Photo 2.3-25).



Photo 2.3-22 Crushing and Sieving of Rocks for Zircon Separation



Photo 2.3-23 Elutriation and Drying of Selected Samples by Sieving



Photo 2.3-24 Zircon Separation by using Stereomicroscope



Photo 2.3-25 Zircon Separation by using Stereomicroscope and Preparation for Analysis

In the future, the zircon separation of the sample will be repeatedly carried out for the routine. On the other hand, it was decided to further attempt to be performed the specific gravity separation by using heavy liquid or sodium polytungstate (SPT) and the centrifugation by using the centrifuge machine in the next training at UEM.

(d) 2019

Training in 2019 was limited to the short-term training in UEM on May (Table 2.3-5).

Table 2.3-5 Training for the UEM, 2019

Training Item/Schedule		Content
		UEM
Mozambique (9th Training)	20/5~31/5	- Practical training for separation of zircon - Consideration of curriculum - Preparation for a publication of the training result - Model lecture for ore deposit
Mozambique (10th Training)	11/11~15/11	Hold JCC and Final Seminar of this Project

#### 9th Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)
- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi (MMTEC)

In the short-term training in UEM on May, practical training for zircon separation was performed by using the existing materials and equipment in the UEM as a follow-up the previous training which was carried out in Akita University on October 2018 and in UEM on November 2018.

The samples used in this training were granodiorite collected in Manica Province by Mr. Helnani of assistant who have been actually conducted practical training in UEM and Akita University (Photos 2.3-26 and 2.3-27).

Materials that could not be secured by the previous practical training at UEM were 4 items, which were iron mortar for rock crushing, strong Nd magnet for magnetic mineral separation, heavy liquid (sodium polytungstate (SPT)) and centrifugal separator for density separation (Photographs 2.3-28 and 2.3-29). In this time, it was possible to secure the materials to be used for the zircon separation in UEM except for the iron mortar. In this training, trainees were able to perform very efficient separation by carrying out the specific density separation and centrifugal separation, which were issues in the previous training (Photo 2.3-30).

The zircon was finally separated into polished section for observation and analysis in UEM (Photo 2.3-31).



Photo 2.3-26 Condition of Rock and Crushing for Mineral Separation of Zircon



Photo 2.3-27 Preparation of Separation by Sieving and Panning of Pulverized Rock





Photo 2.3-28 Preparation of Heavy Liquid (SPT) and Heavy Liquid Mineral Separation by Centrifugal Separator

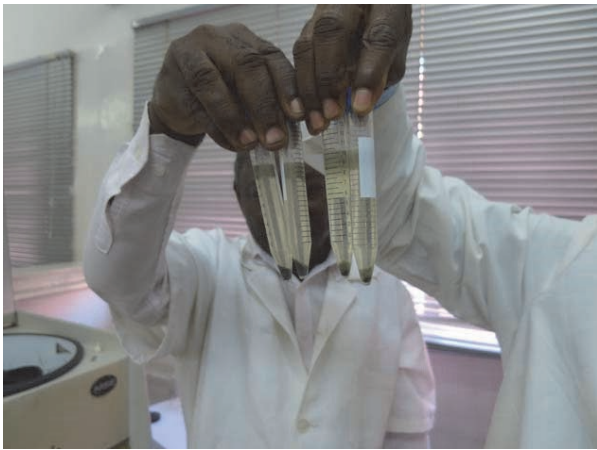


Photo 2.3-29 Results of Heavy Liquid Mineral Separation and Preparation of Samples for Zircon Separation

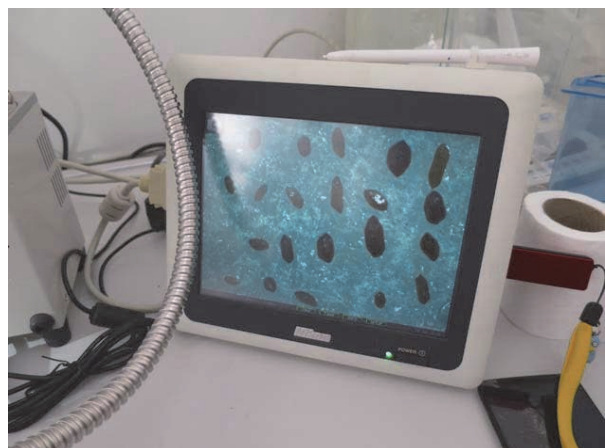


Photo 2.3-30 Mineral Separation of Zircon by Stereomicroscope



Photo 2.3-31 Preparation of Polished Section for the Separated Zircon

Based on the results of this practical training, a procedure manual for zircon mineral separation in UEM was prepared by UEM personnel, and it was decided that this separation process will be maintained in the laboratory as a routinization.

### 2.3.2 Training for Instituto Superior Politécnico de Tete (ISPT)

Training is divided into the short-term training conducted at the ISPT in Mozambique, and at Akita University and related universities and institutions in Japan. The contents of these trainings are as follows for each year.

#### (1) Phase 1

##### (a) 2015

In 2015, three short-term training sessions were held in May to June and November to December in ISPT, and October in Japan (Table 2.3-6).

Table 2.3-6 Training for the ISPT, 2015

Training Item/Schedule		Content
Mozambique (1st Training)	25/5~5/6	- Baseline Inspection (gather information of experimental materials, curriculum, laboratory, skills and so on.)
Japan (1st Training)	4/10~24/10	- Visit to related universities, research institutions, and private enterprises in Japan
Mozambique (2nd Training)	30/11~11/12	- Final selection of equipment to donate - Model lecture for coal analysis, world situation of coal and politics of energy, coal geology, and geological mapping

### Baseline Survey (1st Visit to Mozambique)

#### Participants

- Consultant: Koichi Tanaka, Toyokazu Sugawara (JCOAL)  
Yoshimitsu Negishi, Kinuko Matsunaga (MMTEC)

### 1st Short-term Training in Japan

#### Trainees

- ISPT: Dr. Bernardo Miguel Bene, Mr. Arcenio Alberto Ivone Chapot Era,  
Mr. Antonio Ngano Antonio Lisboa

#### Lecturers

- Akita University: Professor Akira Imai, Assistant Professor Ryohei Takahashi  
(Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Toyokazu Sugawara, Junko Saito (JCOAL)  
Yoshimitsu Negishi (MMTEC)

### 2nd Short-term Training in Mozambique

#### Lecturers and Coordinators

- Akita University: Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Toyokazu Sugawara (JCOAL), Yoshimitsu Negishi (MMTEC)

The first short-term training from May to June was focused on the baseline survey. Information of the organization, number of students and teachers, budget status, academic degree acquisition status of teachers, research background, research databases owned by universities, and another information of the existing equipment/instrument/materials and management of maintenance (structure, budget, spare parts, challenge and so on) as basic information of the ISPT were collected. Based on the collected information, further training, and selection/installation of equipment were planned.

In the short-term training in Japan held on October, education and research activities for the related fields in Japan were mainly inspected. Visiting destinations for the training course were Akita University, Hokkaido University, Kyoto University, National Institute of Advanced Industrial Science and Technology, Sanmi Coal Mine, Yufutsu Gas Field, Shimadzu Corporation, Kimitsu Steel Works, and Tomitsu Research Institute for the iron manufacture. In the Akita University, trainees visited laboratories, libraries and related facilities, and participated lectures (model classes) and received explanations about curriculums of Akita University. Additionally, they attended a practical training for making rock thin section, which was requested from them at the start of the project.



Photo 2.3-32 Short-term Training in Japan (1st)

The short-term training in ISPT from November to December was focused on classroom lectures of the utilization of coal, coal resources and method of survey of the coal. At the same time, based on the results of the baseline survey in Mozambique on May and the short-term training in Japan on October, equipment such as the Simultaneous Differential Thermogravimetric Analyzer was selected as an equipment provided for ISPT.

(2) Phase 2

(a) 2016

In 2016, three training sessions were held in August to September and October to November in Mozambique and September to October in Japan (Table 2.3-7).

Table 2.3-7 Training for ISPT, 2016

Training Item/Schedule		Content
		ISPT
Mozambique (3rd Training)	26/8~9/9	- Coordination for management and operation of the analyzer - Model lectures for coal analysis and it's utilization, and recovery of valuable metals
Japan (2nd Training)	26/9~21/10	- Practical training of simultaneous thermogravimetric analyzer
Mozambique (4th Training)	31/10~11/11	- Installation of the equipment and instruction for handling of the analyzer - Instruction for coal analysis - Model lectures for sulfur in coal, recovery of valuable metals, and mineral resources mapping

2nd Short-term Training in Japan

Trainees

- ISPT: Mr. Gilberto Rogaciano Goba Sabonete, Mr. Robate Miguel Cardoso Banda,  
Mr. Terra Eugenio Cossa

#### Lecturers

- Akita University: Professor Akira Imai, Assistant Professor Ryohei Takahashi  
(Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Masafumi Uehara, Junko Saito (JCOAL)  
Yoshimitsu Negishi (MMTEC)

#### 3rd Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi (MMTEC)

#### 4th Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi, Shusaku Miyaike (MMTEC)

During the short-term training in ISPT during August to September, a Simultaneous Differential Thermogravimetric Analyzer, which was a procured equipment, arrived at the ISPT, and the installation condition of the equipment in the laboratory room was confirmed. At the same time, the status of usage of the other existing analytical instruments and the libraries in the ISPT were confirmed following the 2015 baseline survey. In addition, the donation books (seven boxes) donated by Honorary Professor Yamatomi, Tokyo University, were arrived in ISPT, and the status of library registration was also confirmed.

Among the above, in the chemical preparation laboratory, it was pointed out that although there was one nitrogen gas for the Simultaneous Differential Thermogravimetric Analyzer which was supplied in this time, another nitrogen gas was necessary for the usage in the actual analysis (should be constantly stored) (Photo 2.3-33). The calorimeter is currently in use and measures by using the Mozambiquan coal and the standard samples (Photo 2.3-34). Draft in the laboratory is still unavailable with nothing of the air vent and the electrical source. It was pointed out that this draft will be necessary for acid dissolution of samples in the case of future elemental analysis and so on, once again as in last year.



Photo 2.3-33 Installation Condition of Nitrogen Gas



Photo 2.3-34 Installation Condition of Calorimeter

In the mineral preparation laboratory, Labfit's CS-2000 of the Carbon/Sulfur Analyzer, the most expensive instrument, was still unused (Photo 2.3-35). At the time of December 2015, resetting was planned by the LABOTEC engineer of the distributor, however the setting process was still not determined. It was explained that the usage of this instrument would lead to the following elemental analyses, and advised that ISPT should be negotiated with LABOTEC for the set-up, again. In addition, the electric furnaces, drying ovens, etc. were basically arranged in the same condition as the previous inspections, however were not used on a full scale.

The Simultaneous Differential Thermogravimetric Analyzer of SHIMADZU was shipped from Japan in early August 2016 and arrived at Tete at the end of August. The analyzer was storing in the laboratory of ISPT at the moment (Photo 2.3-36). It was instructed that the installation and the initial operation check for the analyzer to be handled by mechanics of SHIMADZU SA should be made a schedule in the next short-term training in ISPT.

In addition, it was also instructed that the installation place for the analyzer should be basically set on the table in this laboratory, and not to avoid placing equipment that vibrates on the same table.



Photo 2.3-35 Labfit CS-2000



Photo 2.3-36 Packaging Status of Simultaneous Differential Thermogravimetric Analyzer

Regarding the status of the library, the books stored at a stock room in the library at the time of confirmation in 2015 were moved to a reference room as previously planned (Photo 2.3-37). In addition for the donation books (seven boxes) donated by Honorary Professor Yamatomi of Tokyo University, which was dispatched from Japan in July and arrived at Tete at the end of August, it was confirmed that the books were being registered as books in ISPT (Photo 2.3-38).



Photo 2.3-37 Condition of Books Storage in the Library



Photo 2.3-38 Status of Registration of the Books Donated by Honorary Professor Yamatomi

The short-term training in Japan during September to October was conducted within the Faculty of Science and Engineering of Akita University. In the training, the proximate analysis method by using the Simultaneous Differential Thermogravimetric Analyzer used in Akita University was learned. In order to install the same analyzer to the ISPT, a manual on the operation and analytical methods of the analyzer was prepared and made available for installation and operation of the analyzer in the ISPT.



Photo 2.3-39 Practical Training by using Simultaneous Differential Thermogravimetric Analyzer at the Short-term Training in Japan



During the short-term training in ISPT from October to November, SHIMADZU SA installed the Simultaneous Differential Thermogravimetric Analyzer in the laboratory, ISPT. After the installation, Professor Sugawara and lecturer Kato were explained how to use the analyzer and carried out various trial measurements. In order to verify the performance of the analyzer, an analysis using a verification sample

(calcium oxalate) was performed, and as a result, it was confirmed that there was no issue in the performance of the delivered analyzer. On the other hand, since it was recognized that the N<sub>2</sub> gas introduced into the analyzer prepared by the ISPT may contain some impurities, it was decided to promptly arrange the highly pure N<sub>2</sub> gas to be prepared by ISPT.

After arrangement of the gas, trial measurements by using atmospheric gas (N<sub>2</sub>) arranged by the ISPT showed that the actual measurement was not stable, and the degree of purity of the gas was assumed to be low. Therefore, a replacement of the cylinder and mounting around the decompressor were newly carried out. On the other hand, the generation of measurement noises which are considered to be caused by the unstable voltage of the power source was also recognized, and the ISPT was informed to add a voltage stabilizing device having a large capacitance in order to improve the measurement accuracy.



Photo 2.3-40 Condition of Test Runs for the Analyzer

Under the above circumstances, Professor Sugawara and lecturer Kato of Akita University were reattached and readjusted a balance portion in the analyzer and performed measurement again. As a result of this adjustments, it was confirmed that a normal result was obtained by the measurement by using a standard sample. After that, the measurement in practical training using a coal sample was carried out, and the instruction was also performed with the aim of the skill acquisition for the related teacher and the technician in the ISPT.

On the other hand, the trouble of attachment between the high purity N<sub>2</sub> cylinders prepared in ISPT and analyzer were not repaired in this training due to the shortage of parts. For the time being, it was decided to use the existing N<sub>2</sub> cylinders and instructed that ISPT should continue to be procure the parts.

Other training included basics of geological mapping and methods of compiling survey results. In this training, a practical instruction on the geological observation was carried out in the actual outcrops around Moatize Coal Mine, which are located in existing of sedimentary rock including coal layers. Contents of the Instruction were a coordinate recording technique of observation points, observation methods for outcrop, methods of discrimination of rocks, relationships between magnetic north and true north, and methods of measurement for dip and strike of geological formations. In addition, a practical



exercise in a lecture hall in ISPT to create geological plane map and section on the scale of 1:2,000 was also performed by using the results of observations at the actual outcrops.



Photo 2.3-41 Condition of Practical Training at an Outcrop  
(left: explanation of observation method, right: practical training for measurement of dip and strike)



Photo 2.3-42 Training for Combining of Survey Result

(b) 2017

Training in 2017 consisted of short-term training in ISPT on May and October to November and the short-term training in Japan on July (Table 2.3-8).

Table 2.3-8 Training for ISPT, 2017

Training Item/Schedule		Content
		ISPT
Mozambique (5th Training)	15/5~26/5	- Practical training for measuring calcium oxalate using simultaneous thermogravimetric analyzer - Instruction for the method of coal mapping - Model lecture for utilization of the coal analysis using simultaneous thermogravimetric analyzer
Japan (3rd Training)	3/7~28/7	- Practical training of simultaneous thermogravimetric analyzer
Mozambique (6th Training)	30/10~10/11	- Practical training for a reaction test of the gasification using simultaneous thermogravimetric analyzer - Consideration of the curriculum - Model lectures for coal chemistry and its utilization

### 3rd Short-term Training in Japan

#### Trainees

- ISPT: Mr. Albuquerque Leonardo Rimua, Mr. Robate Miguel Cardoso Banda, Mr. Terra Eugenio Cossa

#### Lecturers

- Akita University: Professor Akira Imai, Assistant Professor Ryohei Takahashi (Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato (Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Masafumi Uehara, Junko Saito (JCOAL), Shusaku Miyaike (MMTEC)

### 5th Short-term Training in Mozambique

#### Lecturers and Coordinators

- Akita University: Professor Katsuyasu Sugawara, Lecturer Takahiro Kato (Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Shusaku Miyaike (MMTEC)

### 6th Short-term Training in Mozambique

#### Lecturers and Coordinators

- Akita University: Professor Katsuyasu Sugawara, Lecturer Takahiro Kato (Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Shusaku Miyaike (MMTEC)

In the short-term training in May, the ISPT have been reported trouble on operation of analyzer so far from last training in ISPT. Therefore at the beginning of the training, a recheck of the analyzer operation was performed by ISPT technicians. As a result of this recheck, it was confirmed that the attachment between the atmospheric control unit (FC-60A) and the N<sub>2</sub> carrier gas conduit tube were loose.

Additionally, as a result of checking the operating method carried out by the ISPT technician, the misunderstanding to read value in the gauge of the decompressor at the side of O<sub>2</sub> cylinder was found. Since this was identified as the cause of the failure, the carrier gas conduit tube was connected in an exact way again. After this trouble shooting, it was confirmed that the operation became normal by using coal sample. Based on this trouble, the amendment for the operating manuals of the Simultaneous Differential Thermogravimetric Analyzer, which is including the setting method of the decompressor for carrier gas, was implemented as a part of training in ISPT.

On the other hand, measurements using calcium oxalate (CaC<sub>2</sub>O<sub>4</sub>) were also conducted on a test basis, and it was confirmed that there were no abnormalities in the main body of the device. As a result, the ISPT technicians were commenced to operate the analyzer as a practice again. In the practical training, the technician checked the operation manual prepared by himself and checked each operation again by using actual analyzer in ISPT.



Photo 2.3-43 Explanation on the Trouble of Operation to the ISPT technician



Photo 2.3-44 Decompressor Gauge (O<sub>2</sub> cylinder)



Photo 2.3-45 Practical Technical Instruction to Technician of ISPT

In addition to the above operation confirmation, the measurement result of the coal sample performed by this time was confirmed that there were no abnormalities during the operation of the atmosphere control

unit in the analyzer. And, the analysis method of the measurement result (content of moisture, volatile, fixed carbon and ash in coal) was explained to the technician again.

On the other hand, the technician led the measurement for the coal samples by using the analyzer and carried out the measurement again, and the procedure was reconfirmed by their own. At that time, the method of handling the decompressor of the atmospheric gas cylinder which caused the equipment failure was confirmed with particular emphasis, and the understanding of technicians was deepened.

In addition, the operating manuals prepared at the time of the short-term training in Japan on last year were revised as appropriate in respect of the items that were lacking and not sufficiently understood. Furthermore, the importance of various records in performing the analysis was explained and an original recording sheet in ISPT was prepared by technicians as a part of training. In the recording sheet, there are entry columns about a value of residual pressure in the cylinder, a cleaning history after the measurement and so on. Based on this sheet, this operation will be able to ensure the maintenance and management of the analyzer.



Photo 2.3-46 Practical Training for Analysis by ISPT Technicians  
(left: setting for analysis condition, right: sample crushing for preparation of analysis)

As described above, examination for the practical skill were conducted to confirm the familiarity of technicians and teachers with the handling methods of donated equipment. Preparation of the amendment for procedure manual was planned based on the assessment of their level of understanding during practical trainings for operation of analyzer. After the assessment, it will be determined the items to be appropriately modified in the short-term training.

In order to evaluate a learning level of ISPT technicians and teachers in relation to the measurement by using the analyzer, a comparison of analysis result between the result in ISPT and in Akita University, which was used to apply same samples. The samples for analysis were coal samples collected from Vale Moatize Coal Mine, which are comprised of coal from Chipanga Formation, cooking coal and steaming coal. At this time, it was confirmed that the proximate analysis by using the Simultaneous Differential

Thermogravimetric Analyzer should be performed by technicians and teachers of ISPT, which includes the crushing and split of samples as preparation of the analysis.

On the other hand, a training for basics of geological mapping was also conducted in the actual outcrops. Items of the training was included estimation methods of the formation process and depositional transition in sedimentary basin around Moatize Coal Mine. In the training, rock characteristics of the geological basement before the formation of sedimentary basin, topographical features of the surface on satellite image and the distribution of geology in the area were explained. Furthermore, interpretation methods for estimation about the existence of coal layer, transformation of litho facies, transition of depositional environment and potentiality of formation of coal field were instructed. Trainings were comprised of a lecture at class room in ISPT and at actual outcrops in the field. In the field, geological field excursion was carried out at the Karro System near the Moatize Coal Mine, which was a basement rock and includes coal layers. Method of measurement for preparing a columnar section was trained at the actual outcrops, and the columnar diagram was prepared using the obtained observed values at the outcrops.

In the training in Akita University on July, practical training for the measurement by using the Simultaneous Differential Thermogravimetric Analyzer was continued same as the short-term training in Japan on 2016 and in ISPT on this May. The training site was within the Faculty of Science and Engineering of Akita University. The basic measurement method was learned by the practical training so far. In this practical training, while continuing to increase the measurement experience, it was also learned how to maintain and manage the analyzer and troubleshooting of the equipment. During this training, the operation manual was revised by adding the analysis method of the measurement result in this practical training, and the maintenance manual was also newly prepared.



Photo 2.3-47 Practical Training on the Method of Measurement for the Simultaneous Differential Thermogravimetric Analyzer and Maintenance of the Analyzer in the Short-term Training in Japan

In the short-term training in ISPT from October to November, a practical instruction on handling of the Simultaneous Differential Thermogravimetric Analyzer which was donated by this project. Firstly, a practical training for calorimetric measurement using the analyzer was carried out. Measurement of

exothermic and endothermic reactions using calcium oxalate ( $\text{CaC}_2\text{O}_4$ ) were carried out while reaffirming the level of comprehension of the content which has been carried out in the short-training in Japan so far. This training was led to the conclusion that the understanding of the measurement procedure and the interpretation of the measurement results was reached to generally at a satisfactory level.



Photo 2.3-48 Practical Skill Instruction to ISPT Technicians  
(left: analytical condition setting, right:  $\text{N}_2$  gas handling)

As a result of checking the measurement result of the analytical practical training using a sample of the calcium oxalate which was carried out this time, it was confirmed that oxygen in the air flowed into the atmosphere gas. Therefore, the cleaning of the equipment centering on the packing was instructed. After the cleaning was completed, the coal samples (LCS coal layer in Vale Moatize Coal Mine) were used to measure the gasification reaction, and then the gasification reaction was measured. In the measurement, the technicians exchanged the atmospheric gas ( $\text{CO}_2$ ), replaced the gas in the furnace, and prepared the measurement programs, and then they started the actual measurement.

In addition, a conversion exercises on the basis of measurement (arrival basis, anhydrous basis, anhydrous ash-free basis) were instructed by using results of the past analyses for coal samples during previous trainings.

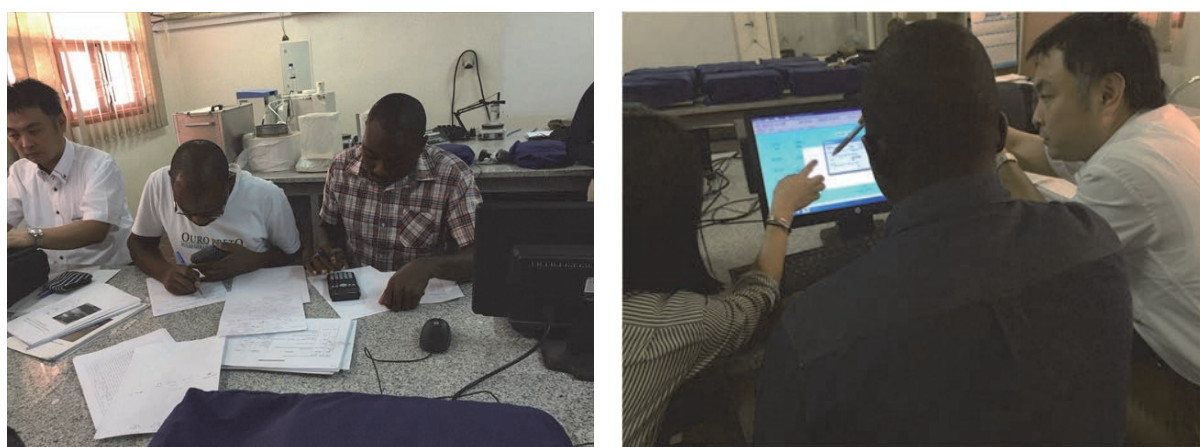


Photo 2.3-49 Practical Training for Analysis by ISPT Technicians  
(left: training for conversion of analysis results, right: setting of the programs)

In addition to the above instruction, it was confirmed that the gasification reaction measurement of the coal sample was normally completed by this measurement. Therefore, an another measurement was carried out using another sample (UCS coal layer in Vale Moatize Coal Mine) in the same way. In the future, it was confirmed that gasification reaction measurements should be carried out using wide variety of coal samples to confirm the reproducibility of the experiment and to examine the characteristics of each coal bed. At the same time, the measurement procedure for the coal gasification reaction measurement, which was prepared by their own during previous trainings, was instructed in this training again.

A lecture was also given on the analysis method of the obtained measurement results, and teachers and technicians carried out data conversion and analysis practical training using the data obtained by them so far.

At this time, the difference between the reproducibility of the experiment and the result of changing the parameter (gasification temperature) was verified several times by changing the experimental parameters of three kinds of coal samples.



Photo 2.3-50 Analytical Training by ISPT Technicians (left: sample preparation, right: programming)



Photo 2.3-51 Lectures and Practical Training on Analysis (left: condition of lecture, right: analysis work)

(c) 2018

Training in 2018 consisted of the short-term training in ISPT from May to June and October, and the short-term training in Japan on November (Table 2.3-9).

Table 2.3-9 Training for ISPT, 2018

Training Item/Schedule		Content
		ISPT
Mozambique (7th Training)	28/5~5/6	- Practical training for a proximate analysis and reaction test of the gasification using simultaneous thermogravimetric analyzer - Consideration of the curriculum - Model lectures for coal gasification and it's utilization
Japan (4th Training)	1/10~26/10	- Practical training for analysis using simultaneous thermogravimetric analyzer - Practical training for titration analysis - Practical training for carbon-surfer (CS) analysis, inductively coupled plasma (ICP) analysis, and atomic emission spectroscopy (AES) analysis
Mozambique (8th Training)	19/11~30/11	- Practical training for a reaction rate analysis using simultaneous thermogravimetric analyzer - Consideration of the curriculum - Model lecture for the oxidation of coal

#### 4th Short-term Training in Japan

##### Trainees

- ISPT: Mr. Neves Semente Jemuce, Mr. Pedro Domingos Dauce

##### Lecturers

- Akita University: Assistant Professor Ryohei Takahashi  
(Faculty of International Resource Sciences)  
Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka, Masafumi Uehara, Junko Saito (JCOAL)  
Yoshimitsu Negishi (MMTEC)

#### 7th Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Shusaku Miyaike (MMTEC)

#### 8th Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University: Professor Katsuyasu Sugawara, Lecturer Takahiro Kato



(Faculty of Engineering Science)

- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi (MMTEC)

In the short-term training in ISPT on May, a confirmation of the operation condition on the Simultaneous Differential Thermogravimetric Analyzer and a practical instruction for handling were held. In the instruction, the usage condition of the analyzer was checked from the measurement record book in use, and the content and method of the description were instructed. In the current record book in use, there was a shortage of columns describing the cumulative operating hours. Regarding this, the column was added to the existing book and it was explained the actual usable hours of the heaters in the analyzer. And, the inside of the Simultaneous Differential Thermogravimetric Analyzer was checked, and it was confirmed that the daily cleaning by ISPT has been carrying out normally so far.



Data	Técnicos	Amostra		Cálculo 1/2		Cálculo de Energia		T. de Utilização		Resultados da T. Final	
		Alu. No. Circulo	Identificação	Nº (Mg)	Cal	Início	Fim	HP	MV	C.F.	Adm.
12.05.18	COAL/ANSA	1	ANCS	CO-2-3.950	PT	8:00	8:20	✓	20	1664.50	1664.50
18.05.18	COAL/ANSA	2	ANCS	CO-2-3.950	PT	8:00	8:20	✓	20	1664.50	1664.50
23.05.18	COAL/ANSA	3	ANCS	CO-2-3.950	PT	8:00	8:20	✓	20	1664.50	1664.50
28.05.18	COAL/ANSA	4	ANCS	CO-2-3.950	PT	8:00	8:20	✓	20	1664.50	1664.50
30.05.18	COAL/ANSA	5	ANCS	CO-2-3.950	PT	8:00	8:20	✓	20	1664.50	1664.50
31.05.18	COAL/ANSA	6	ANCS	CO-2-3.950	PT	8:00	8:20	✓	20	1664.50	1664.50
ANÁLISE JORNALIA com despesas (Revisões)											
28.05.18	COAL	51	S-1	JUST	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	52	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	53	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	54	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	55	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	56	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	57	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	58	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	59	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	60	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	61	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	62	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	63	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	64	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	65	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	66	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	67	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	68	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	69	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	70	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	71	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	72	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	73	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	74	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	75	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	76	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	77	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	78	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	79	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	80	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	81	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	82	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	83	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	84	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	85	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	86	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	87	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	88	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	89	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	90	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	91	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	92	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	93	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	94	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	95	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	96	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	97	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	98	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	99	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30
28.05.18	COAL	100	S-1	ANSA	3000	6:00	7:30	ANSA	11:20	1214.30	1214.30

Photo 2.3-52 Practical Skill Instruction to ISPT Technicians

(left: instruction on how to record the record book in use, right: status of the record book)

In addition to the instruction on the operation, a practical training for the proximate analysis was also commenced. Understandings for interpretation method of the following three items were instructed by the practical analysis. The analytical samples were three types of coal samples brought from Japan.

- ① Causes for the difference of the water content in coal (which is shown characteristics of the inversely proportional to the carbon content in coal, and it is explained that the difference of each water content is caused by the chemical structure of coal).
- ② Classification of coal (which is converted to anhydrous ash less basis based on analytical results, and classified the coal samples (ASTM and JIS)
- ③ The relationship between the volatile content and the degree of coalification (which was explained the decrease in volatiles and the increase in the heating value generated due to the degree of coalification, and also explained the relationship between the volatile content and the ignition characteristics of coal)



Photo 2.3-53 An Instruction on Analytical Methods for ISPT Teachers and Technicians by Professor Sugawara

In addition, gasification reaction measurement of coals was carried out using two samples (Australian coal and Mozambique coal) in the proximate analysis results of the three samples. In the measurement, the technicians confirmed and carried out the setting of the atmosphere gas and the temperature increasing program different from the proximate analysis. In addition, it was interpreted the differences between carbon content, water content and volatile content by using the results of proximate analysis and the results of elemental analysis of each sample brought from Japan.

When the results of the coal gasification reaction measurements were confirmed, a temperature rise was observed which suggested that oxygen remained (or flowed) in the furnace of the analyzer. The packing of the Simultaneous Differential Thermogravimetric Analyzer was cleaned, and the gasification reaction was measured again.

The short-term training in Japan on October was conducted within the Faculty of Engineering Science of Akita University. A practical training was conducted using the Simultaneous Differential Thermogravimetric Analyzer same as in 2016 and 2017, and also learned up to kinetic analysis. Assuming that the future of the ISPT will also require trainings in basic analysis, a practical training and improvement of skills were also attempted on water quality analysis by titration method and analysis by multi-component analyzer. Through this practical training, a manual on reaction rate analysis using differential thermal analyzer, water quality analysis by titration method, simultaneous analysis of carbon and sulfur, principle of ICP atomic emission spectrometry and atomic absorption spectrometry, and measurement and interpretation of these analyses were newly prepared.

One of the participants in this training was also visited to the related organization and research facilities to inspect a condition to the education and study in Japan, and the participants were to be referred to in future curriculum in ISPT. Visiting destinations for the training course were Hokkaido University, Kyushu University, Bibai Coal Mine, Higashidani Limestone Mine, Kyushu Cement Plant, Idemitsu Coal Yard,

Idemitsu Coal and Environment Research Laboratory, Kimitsu Steel Works, and Isogo Thermal Power Station.



Photo 2.3-54 Practical Training on Velocity Analysis (left) and Titration Analysis Methods (middle and right) in the Short-term Training in Japan



Photo 2.3-55 Coal Mine (left) and the Inspection (right) at the Short-Term Training in Japan

In the short-term training in ISPT on November, the following trainings were carried out: ① check of measurement reproducibility of the Simultaneous Differential Thermogravimetric Analyzer and confirmation of the revised version of the procedure; ② confirmation and instruction of the textbook for student instruction; and ③ instruction of the velocity analysis by the Simultaneous Differential Thermogravimetric Analyzer.

For check of the measurement reproducibility of the donated Simultaneous Differential Thermogravimetric Analyzer of the above ① and confirmation of the revised version of the procedure manual, it was checked the existing measurement data of coal, and whether the data was reproducible within the same sample (Photo 2.3-56). Since the installation of the Simultaneous Differential Thermogravimetric Analyzer, it has been confirmed that the reproducibility is not problematic because 100 or more measurements have been performed independently. At this time, the operation procedure manual of the analyzer was revised, and the cleaning method was also included in the maintenance procedure. On the other hand, it was advised to include the equipment list (consumables list) in the

procedure manual, and the list up of the equipment was carried out. This makes it possible to manage and operate the product without the inventory being exhausted. In addition, it was confirmed that some of the calculating formulas were incorrect in the procedure before the revision, but were revised in this revision at this time.

As the above-mentioned confirmation, it was decided to confirm that there were no abnormalities in the analyzer under the present conditions, and to confirm again whether there were any abnormalities in the operation of the analyzer at the time of the practical training of velocity analysis to be carried out later (the result of this confirmation, there were no abnormalities).

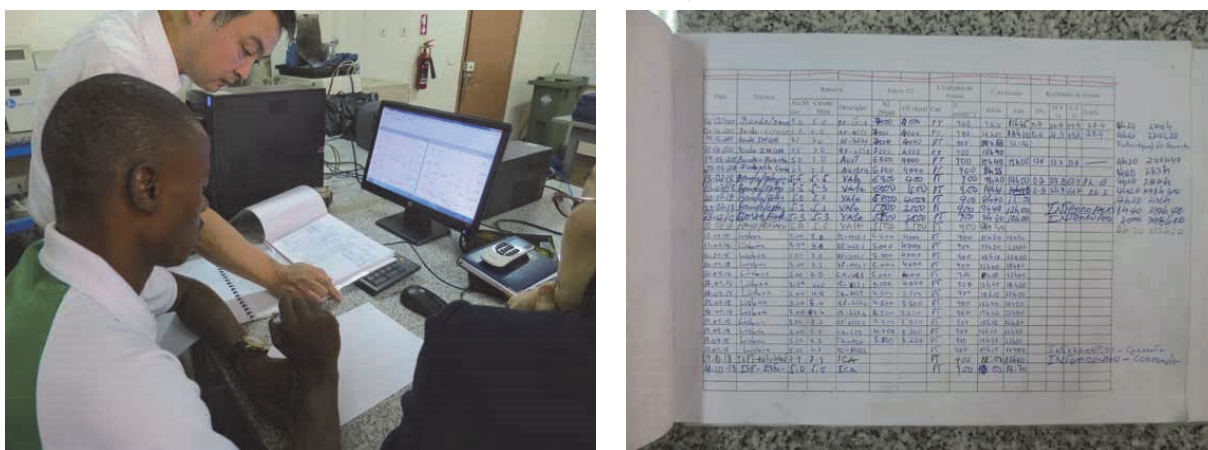


Photo 2.3-56 Confirmation of Measurement Reproducibility by the Simultaneous Differential Thermogravimetric Analyzer

For a confirmation and instruction of the textbook for students in ISPT on the practical training item ②, the textbook was prepared at the time of the short-term training at Akita University in October, and the title of the textbook is "the chemical analysis of the coal occurred in Mozambique". In the course of the revised curriculum, there was a subject of mineral concentration and metallurgy, which was scheduled to be part of the lecture in the course.

The following three points were instructed.

- Content of the textbook is difficult, so it is better to make it easy for students to understand it in easy content. Especially, in the case of grades 2 to 3 of the faculty, the analysis using the differential and integral calculus is sufficient for the part of the velocity analysis. The students will despair of their study for this matters instructing to do something difficult.
- As for the velocity analysis using calcium carbonate, there is currently calcium oxalate as a reference sample of the analyzer, although there is no calcium carbonate in the ISPT, it is convenient to make calcium carbonate from calcium oxalate and perform decomposition reactions using the calcium carbonate as a starting material. Reactions can be made on the Simultaneous Differential Thermogravimetric Analyzer.

- The titration experiments shown in the textbook are performed the next time. The materials and equipment required for the titration experiments are simple, however the ISPT does not have the necessary materials and equipment. Based on this, it was confirmed that ISPT should be purchased the required materials (stands for fixing cylinders, indicators, etc.) until the next time.



Photo 2.3-57 Instruction in Preparation of Textbook for Student Advising

For the instruction of the velocity analysis by the Simultaneous Differential Thermogravimetric Analyzer in the practical training item ③, calcium carbonate ( $\text{CaCO}_3$ ) was prepared by heating calcium oxalate ( $\text{CaC}_2\text{O}_4$ ) with the thermal balance for convenience due to calcium carbonate was not available as the study to be measured during the stay. A reaction rate analysis was carried out on the basis of the weight change, which calcium carbonate was decomposed into calcium oxide ( $\text{CaO}$ ) by changing the holding temperature (Photo 2.3-58).



Photo 2.3-58 Instruction of the Velocity Analysis Method by Simultaneous Differential Thermogravimetric Analyzer

This analysis is a suitable subject for the practical training, which was that it was based on the basic operation and measurement using the analyzer including the pretreatment of the analysis, and the reaction of calcium oxalate to calcium carbonate can be clearly confirmed under the condition of the temperature rise during the measurement.

(d) 2019

In 2019, a total of one short-term training session in ISPT was held in May (Table 2.3-10).

Table 2.3-10 Training for ISPT, 2019

Training Item/Schedule		Content
		ISPT
Mozambique (9th Training)	20/5~31/5	- Practical training for a coal gasification analysis using simultaneous thermogravimetric analyzer - Preparation for a publication of the practical training result - Preparation work for the amendment of manuals and textbook in relation to analyzer - Model lecture for the oxidation of coal

#### 9th Short-term Training in Mozambique

##### Lecturers and Coordinators

- Akita University Professor Katsuyasu Sugawara, Lecturer Takahiro Kato  
(Faculty of Engineering Science)
- Consultant: Koichi Tanaka (JCOAL), Yoshimitsu Negishi (MMTEC)

In the training in May, the following three items were carried out as practical training: ① confirmation of status of usage and operation of the Simultaneous Differential Thermogravimetric Analyzer; ② confirmation of reproducibility of measurement data of the analyzer; and ③ actual measurement for the gasification characteristics of coal by the analyzer.

In order to confirm the status of usage and operation of the Simultaneous Differential Thermogravimetric Analyzer in the practical training item ①, it was checked that the entry log was written in the record book and managed in the same as last time. Since the November of last year, approximately 200 measurements have been made between April and May, and the purpose of the measurements was student training in ISPT. For a checking the Simultaneous Differential Thermogravimetric Analyzer, the initial checking plan was carried out a reaction test of calcium oxalate using nitrogen gas as a carrier. However, the same measurement and checking were not carried out due to the leakage of the nitrogen gas cylinder in ISPT laboratory. Therefore, the reaction measurement of calcium oxalate using carbon dioxide as a carrier gas was carried out, and the endothermic and exothermic reaction of calcium oxalate by the measurement was checked. No exothermic reaction was observed for measurement in a carbon dioxide atmosphere, and it was confirmed that the Simultaneous Differential Thermogravimetric Analyzer was operating normally.

In order to evaluate the reproducibility of the existing measurement data obtained from the previous practical training item ②, the relation between the temperature rise and the response at the time of measurement was summarized (Photo 2.3-59). The results of the evaluation will be the basic data for

presentations at academic conferences in the future. However, the actual summary and evaluation were not completed within this training, and therefore, it was decided to continue to communicate with the Japanese side (with Sugawara Laboratory).



Photo 2.3-59 Checking the Operation and Reproducibility of the Simultaneous Thermogravimetric Analyzer

Regarding to the measurement in relation to the coal gasification characteristics in the practical training Item ③, the actual measurement was started in this training by using Mozambiquan coal, which will be used for a presentation for the conference in the future (Photo 2.3-60). The samples measured during this practical training were coal samples (Sample No. UCS1) collected by Ms. Dulcas at the Moatize Coal Mine of Vale, who is studying a related area at the master's program in the Sugawara Laboratory, Akita University. In the measurement, the temperature was raised respectively to 700°C, 800°C, 900°C, and 950°C in a carbon dioxide atmosphere, and the absorption and exothermic reaction were measured at the same temperature. The measurement time was about 5 hours at each temperature.

Similar measurements will be made with different samples in the future, and a preparation for presentations at academic conferences will be made while continuing instruction from the Japanese side (Sugawara Laboratory).

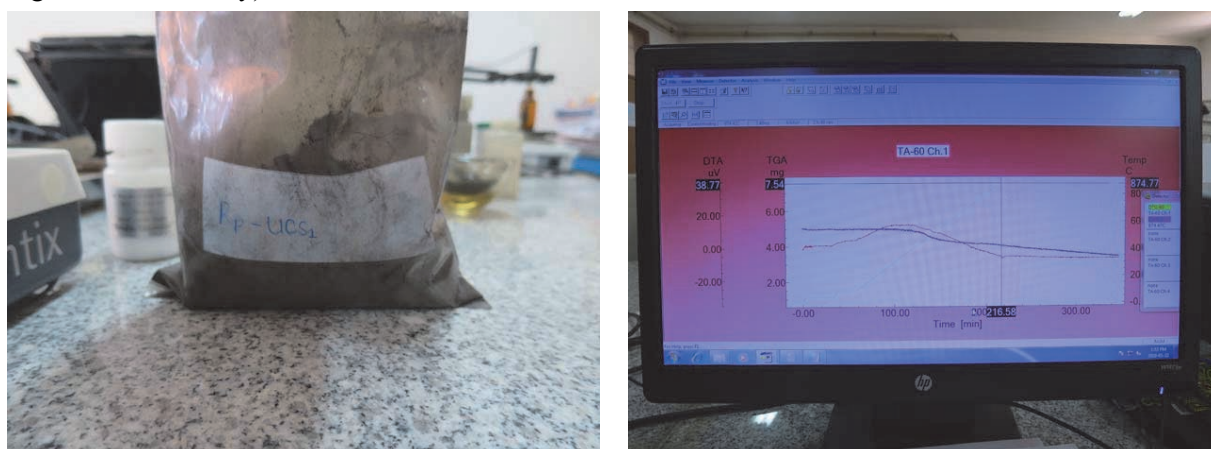


Photo 2.3-60 Coal Samples and Measurement Status

## 2.4 Preparation of Practical Training and Maintenance Manuals for Donated Equipment

The manuals were prepared by trainees from both universities at the time of training in Japan at the Phase 2. Manuals were prepared in accordance with the contents of the training at both universities and the donated equipment, which are comprised of a training manual for the donated equipment and related experiments, and a maintenance and management manual for these. The finally prepared manual is as follows.

### 2.4.1 Manuals to Prepared by the UEM

At the UEM, the following manuals were prepared in relation to the mineral analysis.

- "Manual for Creating Thin Section"
- "Manual for Use of X-ray Diffraction Testing Equipment"
- "Manual for Zircon Separation from Rock Sample"
- "Manual for Analysis of Zircon with Scanning Electron Microscope (SEM)"

### 2.4.2 Manuals Prepared by the ISPT

The following manuals in relation to the coal analysis was prepared at ISPT.

- "Manual for Utilization of the Simultaneous Differential Thermogravimetric Analyzer"
- "Maintenance Manual for the Simultaneous Differential Thermogravimetric Analyzer"
- "Troubleshooting Manual for the Simultaneous Differential Thermogravimetric Analyzer"
- "Chemical Analysis of Coal Produced in Mozambique": This manual can be used to instruct students in coal analysis, and the content consists of titration analysis, which is the basis of chemical component analysis, atomic absorption analysis and ICP analysis, which allow simultaneous analysis of multiple components.

## 2.5 Preparation of Curriculum (draft)

### 2.5.1 Curriculum (draft) at the UEM

The current curriculum for the coursework at the UEM was prepared in 2013. The revision of the curriculum is currently under consideration, and the new curriculum is scheduled to be started in 2021 after being approved by the university and the Ministry of Science and Technology, Higher Education and Occupational Technology. In the revision, a committee was established in the university, and the committee members consist of 10 members. At present, the content of the basic policy for learning geology at UEM is being examined.

The educational policy on the mineral resource field in the curriculum under consideration is ① environmental consciousness and sustainable development, ② economic efficiency and technical evaluation, and ③ exploration and development technology. At present, interviews with relevant private sectors in Mozambique and seminars with relevant organizations are held to summarize the contents of these items. The required skills for each subject and what kind of professionals should be nurture within the policy have been examined. The revised curriculum for the current four year course in the department



will be the same as before. As with the current situation, the courses are planned to be applied geological course and geological mapping and exploration courses for a total of eight semesters. Both courses are held together until the fifth semesters (early third grade).

The knowledges obtained by this training should be included the student lectures and practical trainings thorough an effective usage of donated equipment in the existing curriculum, specifically, the utilization of stereomicroscopes in "Micropaleontology" and "Sedimentology" and the utilization of reflection stereoscope in "Photogeology" (Table 2.5-1). On the other hand, the manuals prepared in the practical training of this project will be used in research specialized to each field in the master's course.

Table 2.5-1 Additional Curriculum in UEM (draft)

Subject	Content			Utilization Equipment	Target				
	Lecture	Practical Training	Learning Purpose		1st	2nd	3rd	4th	Research
Micropaleontology	- Basis of micropaleontology	- Training for separation of microfossils from sedimentary rocks	Learn a method of interpretation about geological history based on a consideration of sedimentary environment in the particular geological horizon and age. In the interpretation, separations and observations of microfossils such as calcareous nannofossil in carbonate rocks will be performed.	Stereomicroscope, constant temperature oven, electronical scale, existing materials in UEM, and so on			○		○
Sedimentology	- Basis of sedimentology	- Training for observation of sedimentary and clastic rocks in detail	Learn a method of interpretation about regional geology based on a consideration of sedimentary environment and sedimentation process. In the interpretation, detailed observations for contained minerals and structures in the sedimentary rocks and clastic rocks. will be performed.	Stereomicroscope			○		
Geological Mapping	- Basis of geological mapping	- Training for creating geological map	Learn the basis of geological interpretation and mapping by using an actual geological and rock observation data in the field.	Existing materials in UEM			○		
	- Basis of interpretation of aerial photograph	- Training for geological interpretation of aerial photographs	Learn how to create geological maps efficiently using aerial photographs as part of geological mapping.	Reflective stereoscope			○		
Petrology and Mineralogy	-	- Training for creating rock thin section and ore polished section	Learn how to make thin and polished sections that are essential for detailed observation of rocks and minerals.	Rock cutting machine, discoplan, grinder, polarization microscope and existing materials in UEM			○		
Geochronology	- Basis of geochronology	-	Learn the characteristics of geological dating methods such as zircon dating, which is important for an understanding of geological interpretation in Mozambique.	-			○		○
	- Geological ages of rocks in Mozambique	- Training for separation of zircon from related rocks	Learn how to accurately separate zircon contained in rocks, in order to increase the opportunities for zircon dating and to help clarification of the geological history in Mozambique.	Stereomicroscope, constant temperature oven, electronical scale, and existing materials in UEM, and so on					○

### 2.5.2 Curriculum (Draft) at ISPT

The current class curriculum of ISPT is operated in accordance with the contents prepared at the time of establishment of the university in 2005. A revised version of the curriculum is currently being prepared, and a new desk lecture and experimental exercise will be added to the lectures and practical trainings for the third grade students of the mineral processing course and the mine planning course, which are comprised of "experimental practical training" related to coal analysis trained in this project (Table 2.5-2). The manual of coal analysis prepared by this project will be used in the lectures and practical trainings as well.

The revised curriculum will be implemented from February 2021, and prior approval from the Ministry of Science, Technology, Higher Education and Occupational Technology is required for the implementation of the curriculum.

Table 2.5-2 Additional Curriculum in ISPT (draft)

Subject	Content			Utilization Equipment	Target				
	Lecture	Practical Training	Learning Purpose		1st	2nd	3rd	4th	Resear ch
Chemical Analysis	- Basis of elemental analysis	- Training for titration analysis	Learn the basis of chemical analysis and interpretation methods of water quality for specific water based on the actual titration analysis of drinking water, river water, drainage, and so on in and out of ISPT, and in Tete Town.	Existing materials in ISPT (need to purchase chemicals)			○		
	- Basis of proximate analysis	- Training for proximate analysis	Learn basic analysis methods to confirm the quality of coal produced from Tete and another area.	Simultaneous Thermogravimetric Analyzer and existing materials in ISPT			○		○
	- Basis of coal analysis	- Training for reaction rate analysis	Learn how to evaluate the quality characteristics of coal according to the quality check by proximate analysis.	Simultaneous Thermogravimetric Analyzer and existing materials in ISPT			○		○
	- Characteristics of coal in Mozambique	-	Learn the quality and characteristics of coal in Mozambique based on the actual measurement data obtained from proximate and related analyses.	-			○		○
	- Basis and method of utilization of multicomponent analyzer	-	Learn the basis of analysis methods and the instruments for multicomponent analysis, which will be of assistance as basic knowledge for students when they entered companies and research institute.	-			○		○



Photo 2.5-1 Consultation on the Curriculum Revision Committee and Individual Lectures (in ISPT)

## 2.6 Implementation of Model Lecture

### 2.6.1 Model Lecture in UEM

#### 1) Lecture 1 "Epithermal Au Deposit and Porphyry Cu Deposit"

Lecture 2 "Kuroko (VMS) Deposit and Mineral Resources in Akita Prefecture located at the northeastern part of Japan"

- Instructor: Professor Dr. Akira Imai, Akita University

- Date and Place of Lecture: Tuesday, 8 December 2015, Lecture Hall in the Department of Geology, UEM

- Number of Participant: 60 persons, Teachers and Students



Photo 2.6-1 State of Lecture in UEM (1)

#### 2) Lecture 1 "Basic of Geological Mapping"

Lecture 2 "Remote Sensing Technique used for Mineral Exploration and Geological Mapping"

- Instructor: Dr. Yoshimitsu Negishi, JICA Consultant

- Date and Place of Lecture: Wednesday, 9 December 2015, Lecture Hall in the Department of Geology, UEM

- Number of Participant: 20 persons, Teachers and Students



Photo 2.6-2 State of Lecture in UEM (2)

3) Lecture "Characteristic Features, Analysis, and it's Utilization of Coal"

- Instructor: Professor Dr. Katsuyasu Sugawara, Akita University

- Date and Place of Lecture: Thursday, 10 December 2015, Lecture Hall in the Department of Geology, UEM

- Number of Participant: 20 persons, Teachers and Students



Photo 2.6-3 State of Lecture in UEM (3)

4) Lecture " Epithermal Au Deposit and Porphyry Cu Deposit "

- Instructor: Professor Dr. Akira Imai, Akita University

- Date and Place of Lecture: Thursday, 1 September 2016, Lecture Hall in the Department of Geology, UEM

- Number of Participant: 22 persons, Teachers and Students



Photo 2.6-4 State of Lecture in UEM (4)

5) Lecture 1 "Introduction to Metal Resources, Hydrothermal Deposit, Hydrothermal Fluids and Alteration Process, and Analytical Methods"

Lecture 2 "Method of Coal Exploration by using Remote Sensing Technique"

- Instructor 1: Assistant Professor Dr. Ryohei Takahashi, Akita University

- Instructor 2: Shusaku Miyaike, JICA Consultant

- Date and Place of Lecture: Friday, 11 November 2016, Lecture Hall in the Department of Geology, UEM

- Number of Participant: 20 persons, Teachers and Students

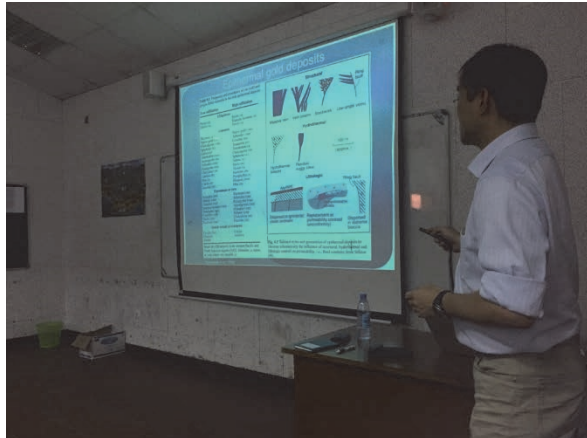


Photo 2.6-5 State of Lecture in UEM (5)

6) Lecture "Geologic Tectonic Setting of Kuroko Mineralization in Miocene"

- Instructor: Professor Dr. Akira Imai, Akita University

- Date and Place of Lecture: Thursday, 18 May 2017, Lecture Hall in the Department of Geology, UEM

- Number of Participant: 40 persons, Teachers and Students



Photo 2.6-6 State of Lecture in UEM (6)

7) Lecture 1 "Introduction to Metal Resources Hydrothermal Fluids and Alteration Process, and Analytical Method"

Lecture 2 "Rare Earth Elements in Granitic Rocks in Southeast Asian Tin Belt"

- Instructor 1: Assistant Professor Dr. Ryohei Takahashi, Akita University

- Instructor 2: Professor Dr. Akira Imai, Kyushu University

- Date and Place of Lecture: Thursday, 9 November 2017, Lecture Hall in the Department of Geology, UEM

- Number of Participant: 35 persons, Teachers and Students



Photo 2.6-7 State of Lecture in UEM (7)

8) Lecture "Hydrothermal activity and formation of metallic deposits -with special reference to mineral deposits in Japan-"

- Instructor: Assistant Professor Dr. Ryohei Takahashi, Akita University

- Date and Place of Lecture: Thursday, 28 November 2018, Lecture Hall in the Department of Geology, UEM

- Number of Participant: 20 persons, Teachers and Students



Photo 2.6-8 State of Lecture in UEM (8)

9) Lecture "Geology, exploration and development of hydrothermal deposits in Japan"

- Instructor: Assistant Professor Dr. Ryohei Takahashi, Akita University
- Date and Place of Lecture: Thursday, 30 May 2019, Lecture Hall in the Department of Geology, UEM
- Number of Participant: 20 persons, Teachers and Students

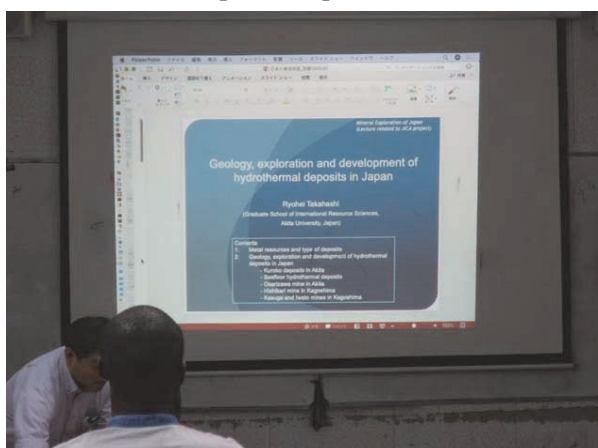


Photo 2.6-9 State of Lecture in UEM (9)

10) Lecture "Geology, exploration and development of hydrothermal deposits in Japan"

- Instructor: Assistant Professor Dr. Ryohei Takahashi, Akita University
- Date and Place of Lecture: Wednesday, 13 November 2019, Lecture Hall in the Department of Geology, UEM
- Number of Participant: 40 persons, Teachers and Students (Photo 2.6-10)

11) Lecture 1 "Composição de Composto de Bioestimulantes a partir de Carvão" and "Combustão Espontânea de Carvão"

- Instructor: Assistant Professor Dr. Takahiro Kato, Akita University
- Date and Place of Lecture: Friday, 15 November 2019, Lecture Hall in the Department of Geology, UEM
- Number of Participant: 40 persons, Teachers and Students (Photo 2.6-10)



Photo 2.6-10 State of Lecture in UEM (10)

## 2.6.2 Model Lecture in ISPT

### 1) Lecture "Characteristic Features, Analysis, and it's Utilization of Coal"

- Instructor: Professor Dr. Katsuyasu Sugawara, Akita University
- Date and Place of Lecture: Wednesday, 2 December 2015, Lecture Hall in ISPT
- Number of Participant: 60 persons, Teachers and Students



Photo 2.6-11 State of Lecture in ISPT (1)

### 2) Lecture "Coal and Energy Situation in Japan and World"

- Instructor: Koichi Tanaka, JICA Consultant
- Date and Place of Lecture: Wednesday, 2 December 2015, Lecture Hall in ISPT
- Number of Participant: 60 persons, Teachers and Students





Photo 2.6-12 State of Lecture in ISPT (2)

3) Lecture "Application of Thermogravimetric Analysis in Coal Analysis"

- Instructor: Professor Dr. Katsuyasu Sugawara, Akita University
- Date and Place of Lecture: Tuesday, 6 September 2016, Lecture Hall in ISPT
- Number of Participant: 90 persons, Teachers and Students



Photo 2.6-13 State of Lecture in ISPT (3)

4) Lecture "Recovery of Valuable Metal from Secondary Resource"

- Instructor: Assistant Professor Dr. Takahiro Kato, Akita University
- Date and Place of Lecture: Tuesday, 6 September 2016, Lecture Hall in ISPT
- Number of Participant: 90 persons, Teachers and Students



Photo 2.6-14 State of Lecture in ISPT (4-1)



Photo 2.6-15 State of Lecture in ISPT (4-2)

5) Lecture "Basic of Geological Mapping for Resource Geology"

- Instructor: Dr. Yoshimitsu Negishi, JICA Consultant
- Date and Place of Lecture: Wednesday, 2 November 2016, Lecture Hall in ISPT
- Number of Participant: 50 persons, Teachers and Students



Photo 2.6-16 State of Lecture in ISPT (5)

6) Lecture "Basic of Geological Mapping and Interpretation Training for the Practical Mapping"

- Instructor: Dr. Yoshimitsu Negishi and Shusaku Miyaike, JICA Consultant

- Date and Place of Lecture: Thursday, 3 November 2016, Lecture Hall in ISPT

- Number of Participant: 20 persons, Teachers and Students



Photo 2.6-17 State of Field Practical Lecture at Outcrop (6-1)



Photo 2.6-18 State of Practical Lecture in ISPT (6-2)

7) Lecture "Sulfur in Coal -it's origin, chemical behavior and the method of elimination-"

- Instructor: Professor Dr. Katsuyasu Sugawara, Akita University

- Date and Place of Lecture: Friday, 4 November 2016, Lecture Hall in ISPT

- Number of Participant: 50 persons, Teachers and Students



Photo 2.6-19 State of Lecture in ISPT (7)

8) Lecture 1 "Application of Thermogravimetric Analysis for Characterization of Coal"

Lecture 2 "Selective Recovery of Rare and Precious Metals from Secondary Resources"

- Instructor: Professor Dr. Katsuyasu Sugawara, Akita University

- Date and Place of Lecture: Wednesday, 24 May 2017, Lecture Hall in ISPT

- Number of Participant: 50 persons, Teachers and Students



Photo 2.6-20 State of Lecture in ISPT (8)

9) Lecture "Coal Chemical and Utilization"

- Instructor: Professor Dr. Katsuyasu Sugawara, Akita University

- Date and Place of Lecture: Thursday, 2 November 2017, Lecture Hall in ISPT

- Number of Participant: 70 persons, Teachers and Students



Photo 2.6-21 State of Lecture in ISPT (9)

10) Lecture "Coal Gasification and it's Practical Use"

- Instructor: Assistant Professor Dr. Takahiro Kato, Akita University
- Date and Place of Lecture: Thursday, 31 May 2018, Lecture Hall in ISPT
- Number of Participant: 50 persons, Teachers and Students



Photo 2.6-22 State of Lecture in ISPT (10)

11) Lecture "Oxidation of Coal"

- Instructor: Assistant Professor Dr. Takahiro Kato, Akita University
- Date and Place of Lecture: Thursday, 22 November 2018, Lecture Hall in ISPT
- Number of Participant: 40 persons, Teachers and Students



Photo 2.6-23 State of Lecture in ISPT (11)

## 12) Lecture 1 "Composição de Composto de Bioestimulantes a partir de Carvão"

### Lecture 2 "Combustão Espontânea de Carvão"

- Instructor 1: Professor Dr. Katsuyasu Sugawara, Akita University
- Instructor 2: Assistant Professor Dr. Takahiro Kato, Akita University
- Date and Place of Lecture: Thursday, 23 May 2019, Lecture Hall in ISPT
- Number of Participant: 100 persons, Teachers and Students

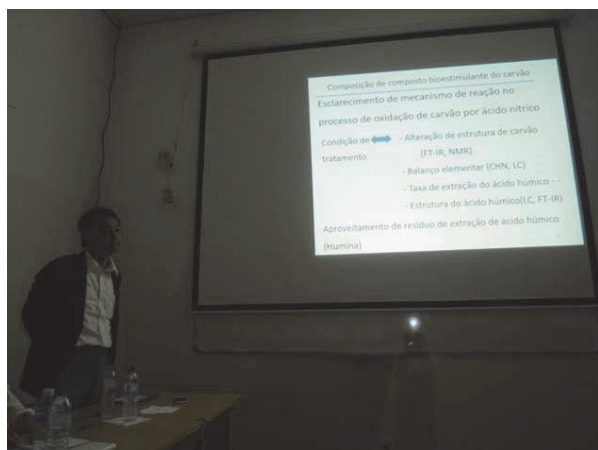


Photo 2.6-24 State of Lecture in ISPT (12)

## 2.7 Preparation for External Publication of Training Results

It is important to maintain and manage the equipment and analytical instruments that have been donated, which have been handled in the practical training, internally in order to operate them at both universities in the future. At the same time, it is necessary to obtain reliability from the outside interested persons for the data obtained by using the installed equipment and analysis equipment.

In order to gain external confidence in the data obtained, it is important to present the method based on the external academic publication. For this reason, even if submission to review academic papers is difficult, it was decided to aim for oral presentations in school newsletters or related academic conferences.

### 2.7.1 Preparations for UEM

The result of the experimental practical training at the UEM is that basic preparation for rock and mineral analysis can be carried out. Among these, the separation of zircon from rocks and the preparation of samples for measurement were made possible as the preparation for the geological dating of zircon at the UEM, which will be an important item for interpretation of geology in Mozambique in the future, which is a great result for geological study in Mozambique.

It is important to standardize the preparation after specifying the procedures in order to ensure the accuracy of separation, such as requiring careful treatment for contamination during zircon separation. Therefore, the publication by UEM clarified the procedures for separating zircons from related rocks. The report was presented as a poster session at the Mozambique Geological Society, which is scheduled for 2020.

### 2.7.2 Preparation for ISPT

Preparation and submission of manuscript for a research paper on gasification of coal by using the donated Simultaneous Differential Thermogravimetric Analyzer will be performed. At the same time, the results of repeated analyses are examined, and the reliability of the measured values will be verified. As a publishing academic organization, international magazines in other specialized fields such as "The Journal of South African Industry of Mining & Metallurgy (SAIMM)" have been cited because it seems that reports on coal gasification for the coal in Tete area are not yet existing. On the other hand, the Portuguese-Mozambique Engineering Society was held in Mozambique on August 2020, and the closing date for submission of the abstract is 15 DEC 2019. Based on this, relevant persons of UEM will prepare for the submission to the Society.

Analysis values other than the Simultaneous Differential Thermogravimetric Analyzer are also required for interpretation of coal gasification to be published. Therefore, the analysis will be conducted in Japan by using the same analyzer in ISPT, and the results of both sides will be jointly interpreted and discussed, and then published in papers and so on.

## CHAPTER 3 Others

### 3.1 Coal Policy Training

The Coal Policy Training was performed as a national training program for the Ministry of Energy of the Ministry of Mineral Resources (MIREME), and the purpose of training was that develops human resources with the knowledge and skills to lead sustainable coal development as the competent authority for the development of mineral resources in Mozambique.

The training was conducted twice, just after the start of Phase 1 and Phase 2.

#### 3.1.1 Coal Policy Training in 2015

##### (1) Training Period

- From Monday, November 2, 2015 to Friday, November 27, 2015

##### (2) Participant of Training

Participants were four officials from MIREME and two officials from the Provincial Department of Mineral Resources and Energy of Tete. The total participants were six administrative officers as follows:

- Name: Mr. Jeronimo Joaouim Cunha  
Position: Technical of Mineral Resource  
Organization: Mineral Resource Section of Ecology, Provincial Direction of Mineral and Energy  
TETE
- Name: Mr. Eduaedo Silvio Francisco  
Position: Technician Environment  
Organization: Mineral Resource Section of Ecology, Provincial Direction of Mineral and Energy  
TETE
- Name: Mr. Cornelio David Ginane  
Position: Mineral Resources Inspector  
Organization: Mining Inspection Department, General Inspection, Ministry of Mineral Resources  
and Energy
- Name: Mrs. Berita Olga Guambe  
Position: Top Technique (Geologist)  
Organization: Department of Coal, Ministry of Mineral Resources and Energy
- Name: Mrs. Julia Armindo Tomo  
Position: Technical Geologist  
Organization: General Inspection, Ministry of Mineral Resources and Energy
- Name: Mrs. Arsenia Luis Zualo  
Position: Geologist  
Organization: Department of Regional geology, National Director of Geology and Mines, Ministry of  
Mineral Resources and Energy



(3) Itinerary and Curriculum of Training

The Itinerary and Curriculum of Training is shown in Table 3.1-1.

Table 3.1-1 Itinerary and Curriculum of Training, 2015

Date	Time	Time	Form	Contents	Lecturer and Destination
Sun Nov 1				Arrival at Narita	
Mon Nov 2	10:00 ~ 12:30			Briefing on rules	JICA
	14:00 ~ 17:00			Program orientation	JCOAL
Tue Nov 3				Holiday	
Wed Nov 4	10:00 ~ 18:00		Visit	Visits to related organizations (METI, Embassy of Mozambique, NEDO, JCOAL and JOGMEC)	METI Coal Div., Embassy, NEDO Environment Dept. and JCOAL
Thu Nov 5	9:00 ~ 12:00	3:00	Lecture	Coal Situation and Energy Policy in Japan	JCOAL Tanaka Koichi
	13:00 ~ 15:30	2:30	Lecture	Coal Development F/S	JCOAL Fukui Tokusaburo
	15:30 ~ 17:30	2:00	Lecture	Coal Development and Environmental Protection	JCOAL Uehara Masafumi
Fri Nov 6	9:00 ~ 11:00	2:00	Lecture	Coal Application Technologies	JCOAL Makino Keiji
	13:30 ~ 14:30	1:00	Visit	Visit to a related organization (JICA Headquarters)	
	15:30 ~ 17:30	2:00	Lecture	Outline of the Mining Law	JCOAL Tanaka Koichi
Sat Nov 7		0:00		Day off	
Sun Nov 8				Travel Tokyo -> Sapporo	
Mon Nov 9	10:00 ~ 13:00	3:00	Visit	Visit an open-pit coal mine	Sunago Mine Igarashi Hiroshi
	14:30 ~ 15:30		Visit	Visit to a coal-fired power plant	Naie Power Station, Hokkaido Electric Power Oikawa Toshinori
Tue Nov 10	11:00 ~ 12:00	1:00	Visit	Courtesy visit (Hokkaido Bureau of Economy, Trade and Industry, and Hokkaido Industrial Bureau of Economy)	Regional Industrial Safety and Inspection Dept., Regional Bureau of Economy Urata Hdeyuki Ito Masayuki
	13:30 ~ 15:30	2:00	Lecture	Visit to Hokkaido University	Hokkaido University Ito Mayumi
Wed Nov 11	9:30 ~ 12:00	2:30	Lecture	Mining Safety Act (matters related to prevention of mine pollution)	Hokkaido Industrial Safety and Inspection Dept. Takuwa Makoto
	13:30 ~ 16:00	2:30	Lecture	Mining Safety Act (matters related to safety hazard)	Hokkaido Industrial Safety and Inspection Dept. Sato Toshimi
Thu Nov 12	10:00 ~ 12:00	2:00	Lecture	Application and Management of Mining Right (Mine Concession) Submission and Management of	Resource and Fuel Div., Hokkaido Bureau of Economy, Trade and Industry Taguchi Haruhiko
		0:00		Travel Sapporo -> Kushiro	
Fri Nov 13	9:00 ~ 16:00	7:00	Visit	KCM Underground coal mine tour and coal preparation plant tour	Kushiro Coal Mine Ichikawa Yoshihisa
Sat Nov 14		0:00		Travel Kushiro -> Tokyo	
Sun Nov 15		0:00		Day off	
Mon Nov 16	9:00 ~ 12:00	3:00	Visit	Visit to a steelworks	Kimitsu Works, Nippon Steel & Sumitomo Metal Kawaguchi Takuya
	14:00 ~ 16:30	2:30	Visit	Visit to coal analysis facilities	Futtsu Research & Engineering Center, Nippon Steel & Sumitomo Metal Uebo Kazuya
Tue Nov 17	10:00 ~ 11:00	1:00	Visit	Visit to coal receiving, storage and shipping facilities	Bulk Terminal, Idemitsu Kosan Uehara Atsushi
	13:30 ~ 15:30	2:00	Visit	Visit to a coal-fired power plant	Isogo Power Station, JPOWER Asano Isao
	16:00 ~ 17:00	1:00	Visit	Cultural training	Sankeien Garden Rental car
Wed Nov 18	10:00 ~ 12:00	2:00	Lecture	Analysis of Economic Efficiency	Nippon Steel & Sumitomo Metal Takei Koji
	13:30 ~ 16:30	3:00	Lecture	Analysis of Economic Efficiency (Exercise)	
Thu Nov 19	9:30 ~ 12:30	3:00	Lecture	Mining and Contracts	Nishimura & Asahi Law Firm Konno Hiroyasu
	13:30 ~ 16:30	3:00	Lecture	Exploration, Remote Sensing, GIS and Ore Reserve Estimation	Mitsubishi Material Techno Miyaike Syusaku
	18:30 ~ 20:30	2:00	Lecture	Social gathering	
Fri Nov 20	9:30 ~ 12:30	3:00	Lecture	Quantity of Resources	Mitsubishi Material Techno Miyaike Syusaku
	13:30 ~ 15:30	2:00	Lecture	Resource Strategy of Major Trading Companies	Metal Resource Business Unit, Mitsui & Co. Watanabe Kensuke
Sat Nov 21		0:00		Day off	
Sun Nov 22		0:00		Holiday	
Mon Nov 23		0:00		Travel Tokyo -> Kitakyushu	
Tue Nov 24	9:00 ~ 11:30	2:30	Visit	Visit to a limestone mine	Higashidani Mine, Mitsubishi Materials Otaka Nobuyuki
	13:30 ~ 15:30	2:00	Visit	Visit to a cement plant	Kyushu Plant, Mitsubishi Materials Kishi Kazu
		0:00		Travel Kitakyushu -> Tokyo	
Wed Nov 25	11:00 ~ 13:00	2:00	Lecture	Relationship between Mine Development and Local Residents	Japan Mining Engineering & Trading Center Kato Hiekazu
				Development of an action plan and response to questionnaire	
Thu Nov 26	13:30 ~ 15:30	2:00	Visit	Visit to a mining machinery manufacturer	KOMATSU Yagami Naotaka
Fri Nov 27	10:00 ~ 12:30			Action plan presentation and closing ceremony	-
Sat Nov 28				Leaving Narita	

### 3.1.2 Coal Policy Training in 2016

#### (1) Training Period

- From Monday, May 23, 2016 to Friday, June 17, 2016

#### (2) Participant of Training

Participants were total eight persons, which was four officials from MIREME, Head of Mineral Resources Department, Manica Provincial Directorate of Mineral Resources and Energy, Head of Mineral Resources Department, Niassa Provincial Directorate of Mineral Resources and Energy, Officer of Mining Department, Tete Provincial Directorate of Mineral Resources and Energy, and Officer of License and Environmental Department, Cabo Delgado Provincial Directorate of Mineral Resources and Energy.

The detail of participants are as follows:

- Name: Mr. MAHOQUE Luis Alberto  
Organization: National Directorate of Planning and Cooperation, Ministry of Mineral Resources and Energy
- Name: Mr. BAMBO Tome Fernando  
Organization: National Directorate of Planning and Cooperation, Ministry of Mineral Resources and Energy
- Name: Mr. BALATE Gabriel Vasco  
Organization: Applied Geology Department, National Institute of Mines, Ministry of Mineral Resources and Energy
- Name: Mr. TIMOTEO Jaime Rofasse  
Organization: Studies and Projects Department , National Directorate of Geology and Mines
- Name: Mr. BATO Oscar  
Organization: Head of Mineral Resources Department, Manica Provincial Directorate of Mineral Resources and Energy
- Name: Mr. RICARDO Amandio Moniz  
Organization: Head of Mineral Resources Department, Niassa Provincial Directorate of Mineral Resources and Energy
- Name: Mr. PAULINO Victorino  
Organization: Mining Department, Tete Provincial Directorate of Mineral Resources and Energy
- Name: Ms. MACINGARRELA Francisca Arselia Tomas  
Organization: License and Environmental Department, Cabo Delgado Provincial Directorate of Mineral Resources and Energy

#### (3) Itinerary and Curriculum of Training

The Itinerary and Curriculum of Training is shown in Table 3.1-2.

Table 3.1-2 Itinerary and Curriculum of Training, 2016

Date	Time		Type	Contents	Company or Organization	
May/22(Sun)				Arrival at Narita	-	
May/23(Mon)	10:00	~	12:30	Briefing of Provisions	JICA	
	14:00	~	17:00	Orientation of Training Program	JCOAL	
May/24(Tue)	10:00	~	17:30	visit	Courtesy calls (METI, NEDO, Embassy of the Republic of Mozambique, JOGMEC, JCOAL)	-
May/25(Wed)	10:00	~	13:00	lecture	Coal Situation and Policy of Japan and the World	JCOAL
	15:00	~	17:00	lecture	Coal Development and Environmental Protection	JCOAL
May/26(Thu)	9:00	~	12:00	lecture	Clean Coal Technology	JCOAL
	15:30	~	17:30	lecture	Introduction to Mining Law	JCOAL
May/27(Fri)	9:00	~	11:00	lecture	F/S of Coal Mine Development	JCOAL
	13:30	~	14:30	visit	Courtesy calls (JICA Headquarter)	JICA
May/28(Sat)				Holiday		
May/29(Sun)				move	Traveling: Tokyo to Kushiro	
May/30(Mon)	10:00	~	13:00	tour	Underground Coal Mine & Coal Preparation Plant	Kushiro Coal Mine (KCM)
May/31(Tue)	6:26	~	10:45	move	Traveling: Kushiro to Sapporo	-
	14:00	~	15:00	visit	Courtesy Calls (METI Hokkaido Bureau of Economy, Trade and Industry; METI Hokkaido Industrial Safety and Inspection Department)	-
Jun/1(Wed)	10:00	~	13:00	tour	Open-pit Coal Mine	Sunago Coal Mine, Sunagumi Co., Ltd.
	14:30	~	15:30	tour	Regeneration of coal from coal washing waste	Town Development Planning Department, Yubari City
Jun/2(Thu)	10:00	~	12:00	lecture	Filing and Administration of Mining rights (Mining Property)	METI Hokkaido Bureau of Economy, Trade and Industry
	13:30	~	15:30	tour	Visit to Hokkaido Univ.	Hokkaido Univ.
Jun/3(Fri)	9:30	~	12:00	lecture	Mine Safety Act; Prevention of Injury	METI Hokkaido Industrial Safety and Inspection Department
	13:30	~	16:00	lecture	Mine Safety Act; Preservation of Mining-induced Pollution	
Jun/4(Sat)	9:00	~	16:00	move	Travelling: Sapporo to Tokyo	-
Jun/5(Sun)					Holiday	
Jun/6(Mon)	9:00	~	11:00	tour	Iron Mill	Kimitsu Works, Nippon Steel & Sumitomo Metal
	13:00	~	15:00		Coal Analysis Facilities	
Jun/7(Tue)	10:00	~	11:00	tour	Coal Bulk Terminal	Coal & Environment Research Laboratory, Idemitsu Kosan Co.,Ltd.
	13:30	~	15:30	tour	Coal Fired Power Plant	Isogo Power Plant, JPOWER
	16:00	~	17:00	tour	Sankeien Garden	-
Jun/8(Wed)	10:00	~	17:00	tour	Traveling: Tokyo to Hakata	-
	14:30	~	16:30	tour	Tagawa City Coal Mining Historical Museum	-
Jun/9(Thu)	9:00	~	11:00	lecture	Rehabilitation of Environmental Destruction due to Mining	Kyushu Bureau of Economy, Trade and Industry
				move	Traveling: Hakata to Kitakyushu	-
	13:30	~	16:00	tour	Kitakyushu Eco Town	Kitakyushu Ecotown Center
Jun/10(Fri)	9:00	~	11:30	tour	Limestone Mine	Higashidani Mine, Mitsubishi Materials Corporation
	13:30	~	15:30	tour	Cement Factory	Kyushu Plant, Mitsubishi Materials Corporation
				move	Traveling: Kitakyushu to Tokyo	-
Jun/11(Sat)					Holiday	
Jun/12(Sun)					Holiday	
Jun/13(Mon)	10:00	~	12:00	lecture	Economical Analysis	Nippon Steel & Sumitomo Metal
Jun/14(Tue)	9:30	~	12:30	lecture	Coal Reserve and Resources	Mitsubishi Materials Techno Corporation
	14:00	~	16:00	lecture	The local community's relationship and mining development	Japan Mining Engineering & Training Center
Jun/15(Wed)				move	Move Tokyo to Izu	-
	13:00	~	15:00	tour	Mining Machinery Manufacturer	KOMATSU Technical Training Center
				move	Move Izu to Tokyo	-
Jun/16(Thu)	13:00	~	15:00		Evaluation Meeting Drawing Up of Action Plan Report	JCOAL
Jun/17(Fri)	10:00	~	11:00		Action Plan Report Completion Ceremony of the Training	JICA JCOAL
Jun/18(Sat)					Departure from Narita	-

## 3.2 Support for Implementation of Long-term Training in Japan

### 3.2.1 Review of Long-term Training Candidates

For long-term trainees, application and selection of training candidates are not covered in this project. On the other hand, it is necessary to match in advance the content of research in master's and doctoral processes at universities that are involved in the selection of candidates and accept training in Japan as well as the relevant professors with the candidates for training. For this reason, in this project, on the occasion of the short-term training in Japan, interviews were conducted between Japanese researchers and training candidates of both universities, and interviews were conducted on the content of research that candidates would like to participate in the training and their desires to apply for long-term training in Japan. As a result of the matching between Japanese side and Mozambique side, it was supported in selecting candidates for long-term training in Japan.

The interviews conducted during the project were as follows.

- During the Second work in Mozambique (November 30 to December 11, 2015):  
Interview with three students applying for long-term training at the UEM together with Professor Sugawara and Professor Imai of Akita University (candidates at the ISPT were in the process of selection) was held.
- During the Third work in Mozambique (August 29 to September 9, 2016):  
Candidates for the both of UEM and ISPT were currently being selected
- During the Fourth work in Mozambique (November 1 to November 12, 2016):  
Seven candidates were interviewed with Professor Sugawara and Assistant Professor Takahashi of Akita University at the UEM (candidates at ISPT were being selected).
- During Fifth work in Mozambique (May 16, 2017 to May 26, 2017):  
Interviews with six candidates at UEM together with Professor Imai of Akita University was held.
- During the Sixth work in Mozambique (October 30, 2017 to November 9, 2017):  
Professor Imai of Kyushu University and Assistant Professor Takahashi of Akita University held interviews with five candidates at the UEM (candidates at Tete Institute of Technology were in the process of being selected).
- During the Seventh work in Mozambique (May 28, 2018 to June 5, 2018):  
It was held interviews with seven candidates at the UEM together with Assistant Professor Takahashi of Akita University, and three candidates at the ISPT together with Professor Sugawara of Akita University.
- During the Eighth work in Mozambique (November 19, 2018 to November 30, 2018):  
Interviews with one candidate at UEM was held.

### 3.2.2 Support of the Research for Long-term Trainees in Japan

Regarding the research support for long-term trainees (foreign students), interviews were held with trainees studying in Japan from Mozambique under the "KIZUNA" Project, and opinions were exchanged on needs and requests for support and training. When the content of the training needs to be changed by

exchanging opinions, advice on points of change, etc. is provided to the university staff. The place of interview is in Japan.

The interviews with Mozambiquan long-term trainees in relation to this Project conducted during the project were as follows:

1) During the short term training in Japan from October 5 to October 23 on 2015, three long-term trainees from Mozambique studying at Hokkaido University (one of whom is an ISPT teacher and two are MIREME employees) joined the site visits of the short-term training in Japan (Bibai open-pit coal mine and Yufutsu gas/oil field). When teaching staff of the universities visited campuses of Hokkaido University and Kyoto University as part of short-term training in Japan, they had interviews with students from the universities (an ISPT teaching staff studying at Hokkaido University and a UEM teaching staff studying at Kyoto University) and their teachers. Trainees from MIREME for coal policy training also had interviews with long-term trainees from organizations related to MIREME during the visit to the campus of Hokkaido University.

2) 3 students of long-term trainees (1 teacher of Instituto Superior Politecnico de Tete and 2 administrative officers of Ministry of Mineral Resources), who were studying at the Hokkaido University, were joined in with the site visit at the Bibai open-pit coal mine at Bibai City and the environmental reclamation site for abandoned coal washing waste dump at Yubari City at the time of the short-term training in Japan for the coal policy on May 23 (MON) to Jun 17 (FRI), 2016.

Furthermore, interviews with 2 long-term trainees studying in the Akita University (1 engineer from Empresa Nacional de Hidrocarbonetos and 1 teacher of Universidade Eduardo Mondlane) were conducted during this short-term training in Japan. Additionally, an interview with 1 long-term trainee, who was newly enrolled at the Hokkaido University (1 associated engineer of MIREME), is due to be performed at the Hokkaido University. In addition, 1 trainee studying in the Waseda University (1 engineer from Ministry of Mineral Resources) is going to be joined in with the site visit at the steel plant of the Nippon Steel and Sumitomo Metal at the time of the short-term training in Japan on September 26 (MON) to October 21 (FRI), 2016.

3) During the short-term training in Japan held from July 3rd to July 28th, three long-term trainees (graduates from Universidade Eduardo Mondlane), who were studying at Akita University, were allowed to participate in the field trip, from July 13th to July 15th, with short-term trainees. Also a long-term trainee who was studying at Hokkaido University, joined in the site visit at the Hokuryo Bibai open-pit coal mine at Bibai City with the short-term trainee. And, a long-term trainee (the lecturer of Universidade Eduardo Mondlane) studying at Kyoto University met the short-term trainee, his senior, during the short-term training in Japan.

4) A presentation meeting by present long-term trainees of the Kizuna Program was held on 31 (FRI) Aug 2018 at JICA in Japan. At that time, consultant team had interviews with three long-term trainees in Akita University, which all of trainees were graduated from the UEM and the one person's present post is the lecturer of the ISPT.

5) During the short-term training in Japan held from October 1st to October 26th, five long-term trainees (two from ISPT and three graduates from UEM), who were studying at Akita University, were interviewed. Additionally, an interview was also held with a trainee at Hokkaido University (from EMEM).

### 3.3 Monitoring of Project Progress

#### 3.3.1 Monitoring with Monitoring Sheet

Monitoring sheets were prepared every six months from 2015, when the project was started. The created monitoring sheets consist of following eight periods.

- First Period : April to September, 2015
- Second Period : October, 2015 to March, 2016
- Third Period : April to September, 2016
- Fourth Period : October, 2016 to March, 2017
- Fifth Period : April to September, 2017
- Sixth Period : October, 2017 to March, 2018
- Seventh Period : April to September, 2018
- Eighth Period : October, 2018 to March, 2019

The progress of this project was described in the Monitoring Sheet, and the Project Design Matrix (PDM) and Plan of Operation (PO) were updated according to the progress of this project. The PDM and PO include the schedule and content of overall for the capacity building project as well as this project. The final PDM and PO are shown in Table 3.3-1, 3.3-2 and Figure 3.3-1.

The actual process and content were almost scheduled for the originally scheduled plan. Among these, the procurement of donated equipment was completed slightly ahead of the initial plan, from the selection of equipment to procurement and placement.

Table 3.3-1 Project Design Matrix for the Overall Project (Goal and Output)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p><u>Overall Goal</u>                      Technical level of the geologists and the mineral resources engineers in Mozambique meets to the global standard, and its effects consequently reach to all quarters.</p>	<p>a. Increase rate of number and type of inquiry for collaborative study and research from domestic/oversea universities, institutes and/or the related companies                      b. Increase rate of research output at international academic societies and/or the related associations                      c. Employment rate to relevant companies</p>	<p>a. Hearing to relevant institutions                      b. Collection of articles and research reports                      c. Check for on-campus records and hearing to relevant people</p>	<p>Significance of basic education and study for geology and resource geology in Mozambique is maintained.</p>
<p><u>Project Purpose</u>                      Level of professional courses at Universidade Eduardo Mondlane (UEM) and Instituto Superior Politécnico de Tete (ISPT) are progressed to the global standard.</p>	<p>a. Increase rate of number and type of study on campus                      b. Increase rate of instructor and technical staff on campus                      c. Increase rate of on-campus budget</p>	<p>a. Hearing to instructor                      b. Check for on-campus records and hearing to related people                      c. Check for on-campus records and hearing to related people</p>	<p>There is no change of target, organization and structure and cutback of budget, instructors and/or technical staff during the implemental period.</p>
<p><u>Output</u>                      1. Current recognition and direction for education and study are clarified.                       2. Circumstances of education and study are arranged based on the current status.</p>	<p>1-a. Education and study activity are conducted based on the revised curriculum of education and study.                       1-b. The above activities include domestic/overseas training and education, and the results are fed back to global standard and domestic program                       1-c. Framework of education and study is modified by the revised curriculum.                       2-a. Arrangement schedule of surrounding environment required for education and study is planned.                       2-b. Framework of arrangement, management and</p>	<p>1-a. Confirmation and hearing for the revised educational and study curriculum, content and activity schedule for education and study, detail schedule of individual study                       1-b. Confirmation and hearing for contents and activity schedule of domestic/overseas training and education based on educational and study curriculum                       1-c. Confirmation and hearing for the revised framework of education and study                       2-a. Confirmation and hearing for item lists and schedule of environmental arrangement                       2-b. Confirmation and hearing for framework and manuals of</p>	<p>a. The direction of education and study decided by working group isn't changed and its activity is performed on smoothly.                      b. There is no cutoff for the shared costs that were initially agreed and/or no downsizing for instructor and technical stuffs.</p>

<p>3. Education and study are conducted under the clarified policy.</p>	<p>maintenance for the selected items on this project is developed.</p> <p>2-c. The selected equipment are set up and operated.</p> <p>3-a. Activity plan is developed based on the revised educational curriculum.</p> <p>3-b. Education and study is conducted with the activity plan.</p> <p>3-c. Number of trainee and student from overseas</p> <p>3-d. Number of collective study and research</p>	<p>arrangement, management and maintenance</p> <p>2-c. Confirmation and hearing for ledger of management and usage for the equipment</p> <p>3-a. Confirmation and hearing for educational materials, contents and activity schedule of domestic/overseas training and overseas education based on the revised educational curriculum</p> <p>3-b. Implement report of education and study activity</p> <p>3-c. Confirmation of on-campus record and hearing to relevant people</p> <p>3-d. Confirmation of on-campus record and hearing to relevant people</p>	
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Table 3.3-2 Project Design Matrix for the Overall Project (Activity, Input and Precondition)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
<p><u>Activity</u></p> <p>1. Current recognition and direction for education and study are clarified.</p> <p>1-1 Recognition of current status and extraction of challenges on the baseline survey</p> <p>1-2 Extraction of necessary improvements and maintenances for education and study</p> <p>1-3 Installment of working team for curriculum, framework and environmental arrangement of education and study</p> <p>1-4 Consideration and development of curriculum and activity plan for education and study</p> <p>1-5 Consideration and development of detail activity plan for individual study</p> <p>1-6 Consideration and development of contents and activity plan for domestic/overseas training and education based on the curriculum of education and study</p> <p>1-7 Consideration and development of framework for education and study</p> <p>2. Circumstances of education and study are arranged based on the current status.</p> <p>2-1 Arrangement of items including the equipment necessary</p>	<p><u>Input at Mozambique side:</u></p> <ul style="list-style-type: none"> <li>- Personnel: Academic, technical staff and student</li> <li>- Equipment: Arrangement space for equipment</li> <li>- Budget: Training fee and travel expenses in Mozambique</li> </ul> <p>➤ Involved parties, principal professors</p> <p>➤ Involved parties, principal professors</p> <p>➤ Involved parties, principal professors</p> <p>➤ Working team</p> <p>➤ Working team and professors</p> <p>➤ Working team</p> <p>➤ Working team</p> <p>➤ Working team and professors</p>	<p><u>Input at Japan side</u></p> <ul style="list-style-type: none"> <li>- Personnel: Consultant, Akita University (advise, training instructor)</li> <li>- Training: Short course, overseas education</li> <li>- Budget: Training fee, procurement and installation cost in Japan</li> </ul> <p>➤ Consultants, Akita university (advise), JICA</p> <p>➤ Consultants, Akita university (advise), JICA</p> <p>➤ Consultants, JICA</p> <p>➤ Consultants, Akita university (advise), JICA</p> <p>➤ Consultants, Akita university (advise), JICA</p> <p>➤ Consultants, Akita university (advise), JICA</p> <p>➤ Consultants, Akita university (advise)</p> <p>➤ Consultants, Akita university (advise), JICA</p>	<p><u>Precondition</u></p> <p>a. The shared costs that were initially agreed and number of instructor and technical staff are ensured.</p> <p>b. There is enough spaces and infrastructures like as a power supply in facility for the equipment arrangement</p>

for education and study depend on the acknowledgement of current framework and capacity			
2-2 Selection and procurement of equipment for installment	➤ Working team and professors	➤ Consultants, Akita university (advise), JICA	
2-3 Development of gradual installment schedule for education and study environment	➤ Working team and professors	➤ Consultants, Akita university (advise), JICA	
2-4 Installment of framework for arrangement, management and maintenance of the equipment	➤ Working team, professors and technical stuffs in charge	➤ Consultants, Akita university (advise)	
2-5 Manual preparation of operation and maintenance for the installed equipment	➤ Working team, professors and technical stuffs in charge	➤ Consultants, Akita university (advise)	
2-6 Procurement and arrangement of the selected equipment	➤ Working team, professors and technical stuffs in charge	➤ Consultants, Akita university (advise), JICA	
3. Education and study are conducted under the clarified policy.			
3-1 Preparation and implementation of educational materials based on the revised educational curriculum	➤ Instructors in charge	➤ Consultants, Akita university (advise),	
3-2 Study implementation based on individual study plan	➤ Instructors in charge	➤ Consultants, Akita university (advise), JICA	
3-3 Selection of trainee and foreign student	➤ Working team	➤ Consultants, JICA	
3-4 Implementation and participate of domestic/overseas training and education	➤ Concerned instructors and students	➤ Consultants, Akita university (instructor), JICA	
3-5 Feedback of contents of training and overseas education into domestic education and study	➤ Concerned instructors and students		
3-6 Implementation of periodic reporting for education and study activity	➤ Concerned instructors and students	➤ Consultants, Akita university (advise), JICA	
3-7 Consideration and recommendation of contents of collective study and research	➤ Working team and instructors	➤ Consultants, Akita university (advise), JICA	

Project Title: Project on Capacity Development in Mineral Resources Sector										Remarks	
Inputs											
Expert											
Short-term Expert										Plan	
										Actual	
Equipment											
Equipment										Plan	
										Actual	
Training in Japan											
Short-term Training (Coal Sector)										Plan	
										Actual	
Short-term Training										Plan	
										Actual	
Long-term Training: 1st Batch (September start)										Plan	
										Actual	
Long-term Training: 2nd Batch (September start)										Plan	
										Actual	
Long-term Training: 3rd and 4th Batch (September start)										Plan	
										Actual	
Activities										Responsible Organization	
Sub-Activities										Japan	Mozambique
<b>Output 1: Governmental capacity is strengthened for sustainable development and promotion of the mineral resources sector.</b>											
1.1 Carry out the training program in Japan in the postgraduate level for governmental officers.										Plan	
										Actual	
1.2 Carry out the training program in Japan for coal sector promotion.										Plan	
										Actual	
<b>Output 2: Educational and Research institutions in mineral resources sector are strengthened to train qualified professionals.</b>											
2.1 Carry out the training program in Japan in the postgraduate level for educators and researchers.										Plan	
										Actual	
2.2 Review and Advise to improve the educational structure and curriculum in related institutions.										Plan	
										Actual	
2.3 Implement model lecture to strengthen the educational capacity.										Plan	
										Actual	
2.4 Provide necessary equipment and facilities for education and research.										Plan	
										Actual	
2.5 Instruct utilization, operation and maintenance of provided equipment and facilities.										Plan	
										Actual	
<b>Output 3: Network in mineral resources sector between Japan and the trained officials and educators is strengthened.</b>											
3.1 Carry out internship program in related organizations and private sectors in Japan.										Plan	
										Actual	
3.2 Strengthen the network between Japan and the trained officials through the follow up program.										Plan	
										Actual	
Monitoring Plan										Remarks	
Monitoring											
Joint Coordination Committee										Plan	
										Actual	
Set-up the Detailed Plan of Operation										Plan	
										Actual	
Submission of Monitoring Sheet										Plan	
										Actual	
Reports/Documents											
Project Completion Report										Plan	
										Actual	
Public Relations											
Press Release										Plan	
										Actual	
										Plan	
										Actual	

Figure 3.3-1 Plan of Operation of Overall Project, 2014 to 2019

### 3.3.2 Holding of Joint Coordination Committee (JCC)

The JCC was held with MIREME, UEM, ISPT and JICA Mozambique Office as members to confirm the progress of the project. The event has been held once a year since 2015 and has been held five times until September 2019.

The contents of each JCC are as follows.

- 1) The First JCC on May 29, 2015
  - Explanation and agreement of work plan
  - Start up the Working Team

- Description of the Monitoring Sheet
- Explanation of the short-term training in Japan and Mozambique, and exchange of opinions
- Explanation and exchange of opinions on long-term training in Japan

2) The Second JCC on September 2, 2016

- Overall process and progress
- Provision of equipment selection and procurement
- Explanation of work plan (the Second Phase) and exchange of the opinions
- Situation explanation and opinion exchange in short-term training in Japan and Mozambique
- Exchange of opinions on long-term training in Japan

3) The Third JCC on May 15, 2017

- Explaining the status of procurement and installation of donated equipment
- Explanation of work plan (the Second Phase) and exchange of the opinions
- Situation explanation and opinion exchange in Japan and local short-term training
- Exchange of opinions on long-term training in Japan

4) The Fourth JCC on November 30, 2018

- Explanation of progress and future of the project
- Explanation of results and exchange of the opinions
- Explanation of the status and results of short-term training in Japan and Mozambique and exchange of the opinions
- Exchange of opinions on long-term training in Japan, interuniversity network and joint research program

5) The Fifth (Final) JCC on November 15, 2019

- Status of Short-term training in Mozambique and Japan, Nov 2018 to May 2019
- Status of laboratory equipment provided by JICA
- Reviewing the activities of this Project, 2015 to 2019
- Reviewing the Final Report (First Draft) of this Project
- Approval of this Project and the Final Report

### 3.4 Assistance for Public Relations of JICA

#### 3.4.1 Creation of a Poster for the J-Summit Booth

A poster of PR for this JICA project was created (Photo 3.4-1). This activity was implemented by METI (Ministry of Economy, Trade and Industry) and JOGMEC (Japan Oil, Gas and Metals National Corporation), two days from May 28 to 29, 2015 on the J-SUMMIT 2 (Japan-Africa Mining & Resources Business Seminar 2015).



Photo 3.4-1 Exhibition of Project Posters at J-Summit

### 3.4.2 Cooperation in Interview by an Industrial Newspaper

An article based on an interview at the JICA report meeting during the short-term training in Japan appeared in an industrial newspaper on December 4, 2015.

### 3.5 Donation of Technical Books

Donation of academic and technical books to ISPT.

#### 3.5.1 Donated Books and Magazines

Technical books: 149 (See attached list)

Technical magazines: 4 magazines, 249 issues (See attached list)

##### 1) Source of donated books

Technical books: Donated by Jiro Yamatomi, Emeritus Professor of the University of Tokyo

Technical magazines: Gjergj Dodbiba, Associate Professor of the Graduate School of Engineering, the University of Tokyo

##### 2) Background of this donation

- When we visited ISPT for baseline survey on June 3rd, we investigated the library of the university and were shocked to see only a small number of books.

- In July, after returning to Japan, Tanaka (Consultant) talked to Shinsuke Murakami, Assistant Professor of the Graduate School of Engineering, the University of Tokyo, on the phone about the poor condition of ISPT's library and asked if the University of Tokyo has any extra technical books.

- On July 28th, Mr. Murakami said that he was going to ask Emeritus Professor Yamatomi if he can donate the books as he left some technical books when he retired in March this year. Mr. Murakami also asked if back issues offered by other professors could be used.

- To the inquiry about technical magazines described above, we replied that we would ask the universities in Mozambique (with the intention of asking them when teaching staff of the universities visit Japan in October).
- On August 27th, Professor Yamatomi replied that he would donate his books.
- In the beginning of October, we told Dr. Bene, President of ISPT, about the donation of technical books and showed a list of back issues of technical magazines. He said that ISPT do not have any of the listed books and magazines and would like to receive them.
- We requested Mr. Murakami to send all the technical books Professor Yamatomi left at the University of Tokyo (mostly in English, some in German) and the back issues of technical magazines (English) donated from Assistant Professor Dodbiba to JCOAL by cash-on-delivery.
- In November, JICA agreed on the donation and the cost was approved as a project expense for shipping of books.
- On November 14th, JCOAL received 14 boxes of books.
- It was confirmed that there were 169 technical books (including proceedings of academic conferences).
- Three consultants and Professor Sugawara from Akita University, who visited ISPT at the end of November for short-term local training, carried 45 books (about 50 kg) in their suitcases.
- On November 30th and December 2nd, the technical books were given to ISPT President Bene.
- Dr. Bene was very glad and said he would send an official gratitude letter from the university to Professor Yamatomi.
- The remaining books will be sent by ship in Phase 2.

### 3) List of Donated Books and Magazines

The list of donated books and magazines are shown in Table 3.5-1.

Table 3.5-1 List of Donated Books and Magazines (1/4)

No.	Title
1	Programing the Finite element Method
2	The Boundary Element Method in Engineering A complete course
3	Mine Wastes Characterization, Treatment and Environmental Impacts
4	Finance for Mine Management
5	Environmental Disasters Anthropogenic and Natural
6	Science Background to Engineering
7	A Land in Motion California's san andreas Fault
8	Environmental Resources
9	The Global Environment Securing a Sustainable Future
10	Earth in the Balance ecology and the Human Spirit
11	Guide to Electronic Measurements and Laboratory Practice 2nd edi.
12	Underground Facilities Experience -Design-Realization
13	Rockbursts and Seismicity in Mines
14	Non-linear Finite Element Analysis of Solids and structure Vol.2 Advanced Topics
15	Economics of the Energy Industries 2nd edi.
16	Energy, Environment and Development
17	Atlas of the World Economy
18	Site Investigation Practice
19	Evaluating Mineral Projects:Applications and Misconceptions
20	The South African Institute of Mining and Metallurgy Symposium S33 10th Congress Technology roadmap for Rock Mechanics
21	Out of the Fiery Furnace The Impact of Metals on the History of Mankind
22	Applied Explosives technology for Construction and Mining
23	Geotechnical Materials in Construction
24	The Boundary Integral Equation Method for Porous Media Flow
25	Underground Storage of Oil and Gas in Salt Deposits and Other Non-Hard Rocks
26	Genetic Algorithms and Engineering Design
27	The Postwar Japanese Economy its Development and Structure
28	Progress in Boundary Element Method s Vol.1
29	Engineering rock mechanics an introduction to principles
30	Financial Analysis for development Concepts and techniques
31	How and Where to find gold
32	Cebirgsdruck und Cebirgsschlage fragen der Standsicherheit Von Grubenbauen
33	Hazardous Waste Site Remendiation The Engineer's Perspective
34	Engineering Behaviour of Rocks 2nd edition
35	Simulation Modeling and Analysis 2nd edition
36	Key Questions in Rock Mechanics:Proceedings of the 29th U.S. Symposium
37	Mine Management
38	International Symposium on the Application of Computers and Operations Research in the Mineral Industries
39	The South African Institute of Mining and Metallurgy Symposium Series S13 Minefill 93
40	Finite Element Analysis From concepts to Applications
41	Rock Engineering Systems Theory and Practice
42	Rock Stress
43	Ground Water Contamination Transport and Remediation
44	An Introduction to Applied Geostatistics
45	Beyond the Limits

Table 3.5-1 List of Donated Books and Magazines (2/4)

No.	Title
46	11th Congress of the International Society for Rock Mechanics
47	Fundamentals of Numerical Reservoir Simulation
48	11th Congress of the International Society for Rock Mechanics the second half century of Rock Mechanics Vol.2
49	The South African Institute of Mining and Metallurgy Symposium Series S33
50	Earth an Introduction to Physical Geology fifth edition
51	Wave Motion in Elastic Solids
52	Theoretical and Laboratory Studies Relative to the Design of salt Caverns for the Storage of Natural gas
53	Application of rock mechanics to cut and fill mining
54	Finite Element Modeling for Stress Analysis
55	Proceedings The 6th International Mining History Congress 2003 Akabira Hokkaido
56	Renewable Energy source for fuels and electricity
57	Numerical Solution of Partial Differential Equations in Science and Engineering
58	Fundamentals of reservoir engineering
59	Variational Methods in Elasticity and Plasticity 2nd edition
60	Wastewater Treatment
61	Finite Element Methods in Mechanic
62	Finite Element Modeling of Environmental Problems Surface and Subsurface Flow and Transport
63	Introduction to Environmental Geotechnology
64	Geotechnology of Waste Management Second Edition
65	Mining with Backfill
66	Finite Elements and Approximation
67	Einführung in den Bergbau
68	Statistics and Data Analysis in Geology Second Edition
69	the Elements of Continuum Mechanics
70	Environmental ECONOMICS an elementary introduction
71	Analytic Element Modeling of Groundwater Flow
72	Dynamics of Fluids in Porous Media
73	Biomangement of Wastewater and Wastes
74	Variational Methods in Mechanics
75	Applied Geotechnology a Text Students and Engineers on Rock Excavation and Related Topics
76	Mining Subsidence Engineering
77	Solving Problems in Environmental Engineering and Geosciences with Artificial Neural Networks
78	Projects Management Technique and Controlling Construction Projects
79	Solving Problems in Environmental Engineering and Geoscience
80	Weak Rock Tunnelling
81	then 1993 Information Please Environmental Almanac Compiled by World Resources Institute
82	Finite Element Approximation for Optimal Shape, Material and Topology Design Second Edition
83	Boundary Element Methods in Solid Mechanics
84	Dictionary/ Outline of Basic Statistics
85	an introduction to Boundary Element Methods
86	Algorithms for Optimum Design and Planning of Open Pit Mines
87	Mining Oil & Gas Explained
88	The Geological Disposal of Nuclear Waste
89	Construction of Fills Second Edition
90	Mining Modelling Advances in Mining Science and Technology,5
91	Rock Mechanics in The National Interest Volume II
92	Book of Proceedings 5th International Mining History Congress
93	Finite Element Procedures in Engineering Analysis
94	Finite Element Computational Fluid Mechanics Series in computational methods in mechanics and thermal sciences
95	Rock Mechanics Design in Ming and Tunneling
96	An Analysis of the Finite Element Method



Table 3.5-1 List of Donated Books and Magazines (3/4)

No.	Title
97	Creep and Relaxation of Nonlinear Viscoelastic Materials with an Introduction to Linear Viscoelasticity
98	Finite Elements for Analysis and Design
99	Finite element Analysis Theory and Programming Second Edition
100	the Finite Element Method in Heat Transfer Analysis
101	Student Solutions Manual for Mathematical Methods for Physics and Engineering
102	Environmental Economics & the Mining Industry
103	Numerical Recipes Example Book (Fortran)
104	Modern Elementary Statistics Eight Edition
105	Third Edition Multivariable Mathematics
106	Numerical Recipes in Fortran the Art of Science Computing Second Edition
107	Mining Engineering Analysis
108	New Horizons in Resource Handlin and geo-Engineering 1994, UBE Oct, 1-5
109	International Society for Rock Mechanics -Proceedings Volume 3
110	International Society for Rock Mechanics -Proceedings Volume 1
111	International Society for Rock Mechanics -Proceedings Volume 2
112	International Society for Rock Mechanics
113	Stress Waves in Solids
114	Quantitative Hydrogeology Groundwater Hydrology for Engineers
115	Mathematical Modeling of Groundwater Pollution
116	Application and Implementation of Finite Element Methods
117	Introduction to Matrix Methods of Structural Analysis
118	Concepts and Applications of Finite Element Analysis
119	Ground Support in Mining & Underground Construction
120	Construction Project Scheduling
121	Principals of Engineering Geology
122	Recycling and Resource Recovery Engineering
123	Computational Methods in Subsurface Flow
124	Finite Elements Computational Aspects Volume III
125	Introduction to Groundwater Modeling Finite Difference and Finite Element Methods
126	Geodynamics Application of Continuum Physics to Geological Problems
127	Finite Element Method for Fluid Dynamics
128	Operations Research Principles and Practice Second Edition
129	Environmental and Safety Concerns in Underground Construction
130	Environmental Geotechnics Volume 2
131	Environmental Geotechnics Volume 3
132	Environmental Geotechnics Volume 4
133	Resources and Industry
134	Lecture Motes in Economics and Mathematical Systems 426 Nonlinear Dynamics in Economics -a Theoretical and Statistical Approach to Agricultural Markets
135	Computer Science and Scientific Computing Finite Element Methods for Viscous Incompressible Flows -a Guide to Theory Practice, and Algorithms
136	Geostatistics -Modeling Spatial Uncertainty
137	Benefit Cost Analysis in Theory and Practice
138	Boundary Element Methods in Engineering Science
139	Economics of Natural Resources and the Environment
140	Cost Benefit Analysis and the Environment
141	Engineering Economic Analysis an Introduction -Includes Interest Table
142	Introduction to Finite and Boundary Element Methods for Engineers
143	the Finite Element Method in the Deformation and Consolidation of Porous Media
144	Constitutive Equations for Engineering Materials -Volume1 -Elasticity and Modeling
145	Finite-Element Modeling of Unbounded Media
146	Geology and Man an Introduction to Applied earth Science
147	Minefill 2001 Proceedings of the 7thInternational Symposium on Mining with Backfill
148	Innpvations in Mining Backfill Technology

Table 3.5-1 List of Donated Books and Magazines (4/4)

No.	Title
149	Lecture Notes in Engineering 1 the Boundary Element Method Applied to Inelastic Problems
150	Lecture Notes in Engineering 4 Boundary Element Method in Geomechanics
151	Lecture Notes in Engineering 9 the Complex Variable Boundary Element Method
152	International Society for Rock Mechanics -Proceedings Volume 1 - Paris1999
153	International Society for Rock Mechanics -Proceedings Volume 3 - Paris1999
154	About Japan Series 2 1997-History of the Modern Japanese Economy
155	About Japan Series 6 1992-Japan's Energy Position
156	Geologic Analysis of Naturally Fractured Reservoirs Second Edition
157	Mining and its Impact on the Environment
158	Ethics in Engineering -Third Edition
159	Environmental Geotechnics
160	Hydro mechanical Aspects and Unsaturated Flow in Jointed Rock
161	Rock Mechanics for Underground Mining
162	Rock Mechanics in the Interest Volume1
163	MassMin 2008 5th International Conference & Exhibition on Mass Mining 9-11 June2008
164	Pacific Rocks -Rock Around the Rim
165	Computer Methods and Advance in Geotechnics Volume2
166	GEM '99 Global Metals Environment
167	Rock Engineering -th20 Anniversary Celebration of the West Japan Rock Engineering Society August2-4 1999 Fukuoka Japan
168	Ultra Haulers -Global Giants of the Mining Industry
169	Drilling and Blasting of Rocks

No.	Title of Magazine
I	"JOM" - an official publication of The Minerals, Metals, & Materials Society (TMS): Vo. 60, No. 1, 2008 ~ Vol. 65, No. 12,2013
II	"Mining Engineering Magazine" - the official publication of The Society for Mining, Metallurgy, and Exploration, (SME) Feb., 2011~Dec. 2014
III	"Chemical & Engineering News" - ACS publication: March 28, 2011" ~ "Dec. 23, 2013
IV	"Science Magazine" - published by the American Association for the Advancement of Science (AAAS) Vol. 339, No. 6119, 2013~ Vol.246, No. 6214, 2014

## CHAPTER 4 Results and Challenges of Projects

### 4.1 Holding Project Seminar in Mozambique

Project Seminar was held by relevant parties, including UEM, ISPT, and MIREME, and the contents and results of the project were disclosed to the outside in this seminar as a final meeting. As a result, the presence of UEM and ISPT as bases for mineral resource-related education, human resource development and education in Mozambique could be enhanced.

The contents of the seminar were as follows:

- Holding date: November 14, 2019 (Thursday)
- Location: Lecture hall in UEM Headquarters
- Host Organization: Ministry of Mineral Resources and Energy
- Co-Host Organization: JICA Mozambique Office
- Participants : MIREME, UEM, ISPT, JICA Mozambique Office, MCTESTP (Ministry of Science and Technology, High Education and Training Vocation), MINEDH (Ministry of Education and Human Development), INAMI (Instituto Nacional de Minas), ENH (Empresa Nacional de Hidrocarbonetos), EMEM (Empresa Moçambicana De Exploração Mineira), Mitsui Corporation and so on
- Content of the Seminar:
  - 1) Opening Remarks
    - Mr. António Eugénio Manda, Director, Directorate of Planning and Cooperation, MIREME
    - Mr. Hidetaka AOKI, Deputy Chief Representative, JICA Mozambique Office
  - 2) Project Outline
    - Outline of the Project by Mr. Koichi TANAKA, JICA Consultant
    - Achievement of the Project in UEM by Dr. Elidio Massuanganhe, Head, Department of Geology, UEM
    - Achievement of the Project in ISPT by Dr. Bernardo Miguel Bene, Director General, ISPT
    - Capacity Development through the Project, Dr. Katsuyasu SUGAWARA, Professor, Faculty of Engineering Science, Akita University
  - 3) Project Detail
    - The Training Program for Capacity Development in Relation to Mineral and Coal Analysis in UEM and ISPT by Dr. Yoshimitsu NEGISHI, JICA Consultant
      - Establishment of Method for Separation of Zircon from Relevant Rocks in UEM by Mr. Sergio Ezequiel Goenha, Laboratory of Minerals, Department of Geology, UEM
      - Training for the Identification of Rock and Mineral by using Analytical Instrument by Mr. Sergio Ezequiel Goenha, Laboratory of Minerals, Department of Geology, UEM
      - Training for Proximate Analysis by using TG-DTA by Mr. Robate Miguel Banda, Laboratory of Chemical Analysis, ISPT
  - 4) Future Vision

- Challenge and Future of Department of Geology, UEM by Dr. Elidio Massuanganhe, Head, Department of Geology, UEM
  - Challenge and Future of ISPT by Dr. Bernardo Miguel Bene, Director General, ISPT
- 5) Discussion
- Comprehensive Discussion
- 6) Closing Remarks
- Mr. António Eugénio Manda, Directorate of Planning and Cooperation, MIREME

The following questions were asked at the seminar.

Q1: Tete Province has a school specializing in geology, which is corresponded to a high school level. Can a cooperation project same as this project be applied to such school?

A1-1 (ISPT): Improved ISPT laboratory can also support to such high school practical trainings. At present, we, ISPT, believe that the results of this cooperation will spread in such a way.

A1-2 (JICA Mozambique Office): Since the collaborative project is planned based on the request of the Mozambique Government, the government will be asked to do so if it appears to be effective in terms of policy.

Q2: What is the size of the screen mesh for zircon separation form a rock sample? Are there machines in the laboratory that use X-rays, etc., that can be safely managed?

A2 (UEM): The mesh size is 200-300 microns. Unlike forepast machines, the X-ray machines don't leak it's x-ray to outside, and there are no safety issues. In addition to cutting and polishing rocks, a safety management is carried out using masks, glasses, gloves, etc. as necessary.

Q3: ISPT started with 45 students only in the course specialized in the mining field. Currently, it has a wide range of courses with a capacity of 2,000 students. According to this situation, Does it diminish the characteristics of a college specialized in mining?

A3 (ISPT): The course of accounting and so on in ISPT was commenced to be requested by the state government under the provincial policy. However, the state is still placing much more emphasis on the subjects in the mining field. There was a proposal as to whether it would be possible to create a course related to oil and gas. However, there is a history in which forwarded to giving priority to the enhancement of the course related to mining.

Q4: What are the prospects for the future of UEM, ISPT, and JICA projects?

A4-1 (UEM): The future of UEM is as a previous presentation. Construction of new research and education buildings in the Department of Geology has begun in the main campus of UEM. UEM would like to increase new equipment for laboratories, classrooms, and office spaces.

A4-2 (ISPT): In 2016, only four master's teachers were in charge, however in 2019, 23 teachers in the total 31 teachers held master's degree and 5 teachers became bachelors. Two teachers will finish their master's course at Akita University in January next year, and they will proceed to the doctoral course, which means they will be able to go to the doctoral course without returning to Mozambique's workplace once in consideration of the JICA. In the future, ISPT would like to enrich the laboratories and provide services to outside, and preserve the sustainability of the laboratory. Additionally, there is also a challenge to strengthen and maintain the international cooperation

between universities in Japan that has been established so far. ISPT would like to place importance on the cooperation with Akita University and extend it to other universities as well. During these activities, ISPT would like to continue forward with a collaborative research among teachers, students and technicians, which master's teachers go to the doctoral course. Based on this situation, an agreement with Kyoto University is also advancing at the moment. In addition, we would like to present the research results in the journal of academic societies, etc. On the other hand, a new curriculum will be commenced in 2021, ISPT would like to expand the study field to iron other than coal through an enhancing practical training including several kind of experiments.

A4-3 (JICA Mozambique Office): Mining activities such as mining in Japan were active until 50 years ago. Japan have also been experienced many kind of events including economic growth and mine environmental issues through these activities at that time. Prof. Sugawara of Akita University talked about a concept of 3E (Economy - Energy - Environment). Regarding this matter, Mozambique should not repeat especially environmental issues same as Japan. In order for mineral resources to contribute to the development of Mozambique, we expect those who participated in training and study in Japan through JICA to work as leaders in Mozambique in the future. We, JICA, would like to consider together with related organization in Mozambique about what kind of cooperation will be possible in the future after the completion of the project.

## 4.2 Achievements and Challenges for UEM and ISPT

### 4.2.1 Achievements and Challenges for UEM

Based on the baseline survey, the enhancement at the UEM was to conduct appropriate experiments and practical training related to the education and research of geology and mineral resources, and to establish a system and environment for the implementation. The enhancement was conducted mainly through training for teachers and technicians, and at the same time, the training was conducted using the donated equipment. Training was divided into short-term trainings in Japan and short-term trainings in Mozambique. Basic trainings were conducted in Japan, and the results obtained from the training were fed back to universities to help their capacity development. At this time, with regard to the enhancement of the system and environment within the school, the management system based on equipment and the environment related to the management were developed.

Training items, achievements, and issues conducted at the UEM are summarized as follows (Table 4.2-1).

Table 4.2-1 Achievements and Issues Based on Training (UEM)

Action items	Outcome	Issue
Method for preparation of rock thin section and ore polish	<ul style="list-style-type: none"> <li>The methods of a maintenance and management for the materials involved in the preparation were learned.</li> <li>The preparation has been routinized, and the order for preparation has been accepted from the external organization.</li> </ul>	<ul style="list-style-type: none"> <li>Maintenance and management require constant supply of consumables to be prepared.</li> <li>→ To schedule the budget applications to relevant organization.</li> </ul>
Methods of observing and identifying rocks and minerals	<ul style="list-style-type: none"> <li>The observation and identification method by using the X-ray diffractometer was learned, and the same procedure was fed back in the university on handling and identification method of the instrument.</li> </ul>	<ul style="list-style-type: none"> <li>In order to operate and maintain the X-ray diffractometer, it is necessary to understand the basis of the instrument and the method of operation, and to establish the operation and maintenance management system on the UEM own.</li> <li>X-ray handling supervisor is required.</li> <li>→ To apply for the acquisition budget after confirming that the operation and maintenance management system can be established after understanding the instrument in the UEM.</li> </ul>
Method of mineral separation for the dating	<ul style="list-style-type: none"> <li>In addition to the availability of donated equipment, methods for the separation of zircon from rocks and the maintenance of materials and equipment were obtained, and the technique of separation were routinized in the laboratory of the UEM.</li> </ul>	<ul style="list-style-type: none"> <li>It is necessary to become recognized the accuracy of zircon separation by related organization of outside, which need to maintain a routine method in the UEM.</li> <li>→ To publicize the methods to outside the university.</li> <li>→ To perform collaborative research on zircon dating and research using zircon, which will be conducted in linkage with the research conducted by teachers abroad.</li> <li>In order to maintain the routines, it is necessary to always supply consumables related to the separation.</li> <li>→ To apply to relevant organization for budget of the maintenance.</li> </ul>
Method of geological mapping for mineral resources	<ul style="list-style-type: none"> <li>Mapping methods specializing in mineral and energy resources were learned rather than basic geological mapping.</li> </ul>	<ul style="list-style-type: none"> <li>There are few professional teachers in this field of general education of mineral resources.</li> <li>→ To feed back the research on mineral resources into the university through a joint research by teachers studying abroad or through international studies.</li> </ul>

Method of geological remote sensing survey for coal resources and of calculating mineral resources volume	<ul style="list-style-type: none"> <li>• Trainees were learned how to interpret coal resources using satellite images and the donated equipment for interpretation by using aerial photographs, and how to calculate the mineral resources volume for coal resources using the interpretation.</li> </ul>	<ul style="list-style-type: none"> <li>• There are few professional teachers in the education field of coal and energy resources. → To feed back the research on coal and energy resources into university by international joint researches through the study abroad of teachers.</li> </ul>
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#### 4.2.2 Achievements and Issues for ISPT

Based on the baseline survey, the content of capacity building at ISPT was to conduct appropriate experiments and practical training related to education and research related to coal evaluation in consideration of regional characteristics, and to construct a system and environment for the implementation. The enhancement was conducted mainly through training for teachers and technicians. At this time, same instrument with Akita University was selected as a donated equipment for ISPT, and actual training was conducted using the instrument as a key equipment. Training was divided into short-term trainings in Japan and short-term trainings in Mozambique. Basic training was conducted in Japan, and the results obtained from the training were fed back to universities to help their capacity development. At this time, with regard to the enhancement of the system and environment within the school, the management system based on equipment and the environment related to the management were developed.

Training items, achievements, and issues conducted for ISPT are summarized as follows (Table 4.2-2).

Table 4.2-2 Achievements and Issues Based on Trainings (ISPT)

Action items	Outcome	Issue
Method for proximate analysis and evaluation of coal using the Simultaneous Differential Thermogravimetric Analyzer	<ul style="list-style-type: none"> <li>• Analyzer was donated and installed, and operating and maintenance methods of the devices were learned.</li> <li>• The repeatability of the measurement was confirmed and the continuous usage became possible.</li> <li>• Instructions have been given to students using the analyzer.</li> <li>• The basis of the coal evaluation method by analyzer was learned.</li> </ul>	<ul style="list-style-type: none"> <li>• In the future, it is necessary to carry out the evaluation of coal characteristics through continuing analysis of various kinds of coal samples by their own. → To gain experiences in analysis and evaluation in relation to coal through study abroad and joint research with Japanese universities. → To link between research contents conducted by the study abroad for teachers and skills for the analysis and interpretation for the purpose of improving the accuracy of analysis and evaluation as well as experience.</li> </ul>
Method of titration analysis and related analysis	<ul style="list-style-type: none"> <li>• Analytical theories and methods were learned.</li> <li>• Textbook on the method was prepared and ready to provide lectures to students.</li> </ul>	<ul style="list-style-type: none"> <li>• This analysis is a necessary item for the future education and research to proceed to the next stage. Therefore, the learned analytical methods need to be</li> </ul>

		<p>performed within the ISPT by their own.</p> <p>→ To try to perform the titration analysis in ISPT by using relevant materials which is available in Mozambique.</p> <p>→ To apply a budget for the acquisition of high performance analytical instruments on the multi-component analysis, when the operation and maintenance management system of the instruments can be established.</p>
Method of coal gasification characteristics analysis and interpretation	<ul style="list-style-type: none"> <li>• Methods of interpreting the characteristics of coals including coal occurred in Tete were learned by using the donated analyzer.</li> <li>• The results of analysis and interpretation are now being published in papers and other publications, and the presence of research capabilities in ISPT will be increased in the future.</li> </ul>	<ul style="list-style-type: none"> <li>• ISPT needs to make analyses and prepare papers by own.</li> <li>→ To continue to publish papers through international joint researches with overseas universities to link the research conducted by teachers studying abroad.</li> </ul>
Method of geological mapping for coal resources	<ul style="list-style-type: none"> <li>• Method of geological mapping specific to coal resources rather than basic mapping and method of interpretation for coal resources at the geological outcrop including actual coal were learned.</li> </ul>	<ul style="list-style-type: none"> <li>• In terms of student education, there are few teachers in geology, and the curriculum is also necessary to consider revision in the current situation.</li> <li>→ To feed back the research on coal and energy resources into university by international joint researches through the study abroad of teachers.</li> <li>• Establishment and maintenance of basic materials and equipment related to the preparation and observation using rock thin section and ore polish are required.</li> <li>→ To procure and install the equipment through applying a budget for the equipment, when it became possible to establish an operational and maintenance system in ISPT.</li> </ul>



## CHAPTER 5 Recommendation for the Future

This project aimed to enhance the educational institution's system to promote sustainable mineral resource development and raise the level of education in faculty specialist courses to international standards by establishing a system and an environment in which experiments and practical training can be carried out appropriately, such as practical training including geological and mineralogical observations, and chemical analysis in relation to coal samples, at the UEM and ISPT.

The project initially conducted a baseline survey to confirm the current status of the enhancement fields of both universities, the current status of the surrounding environment including relevant organizations in Mozambique, and the needs of both universities. Based on the results of this confirmation, the capacity and system for future education and research activities at both universities were enhanced. In order to enhancement of the system, we selected equipment that would be useful for both universities in the future and procured and installed the equipment. Actual capacity enhancement was carried out through short-term trainings in Japan and in Mozambique, which was focused on the utilization for the donated equipment. In the training, participants to the trainings learned the basics of the operational method and the analytical method of the donated equipment in Japan, and then applied the same basics according to the situation of each university in Mozambique, built the system for continuation and maintenance of the environment, and feedback to the educational curriculum was carried out.

The content of the enhancement by this project and future challenges are summarized in the previous chapter. At the same time, both universities discussed future educational and research activities and equipment to be established in the future, and both sides confirmed as follows.

### 5.1 Recommendation for the Future in UEM

At the UEM, the basic curriculum of the Department of Geology is in place, and there is no issues with the basic knowledge of the teacher in charge of lectures. On the other hand, in order to carry out educational and research activities in accordance with the current curriculum, it is necessary for the further upgrades of related experimental equipment. However, the upgrade is still delayed, and in order to enhance the education in the field of geology and mineral resources in Mozambique and its role as a supplier of human resources to industry in the future, it will be important to enhance a desk curriculum and related equipment for practical training and experimentation, and to stimulate research activities at the same time.

It is important to establish a system of maintenance and management in which teachers and technicians are united in order to secure the budget and to manage the equipment. In addition, it is important to provide feedback on research activities being conducted by teachers studying abroad to universities in overseas and to continue research activities after studying abroad.

At the same time, foreign students by Kizuna Program have already returned to UEM. However, the know-how of the project is not fully shared with them at present. The know-how, which has been gained by the participants through their training during the project, should be shared not only in the participants, but also in the university. INAMI under the MIREME has also asked JICA to provide technical know-how on analytical technologies. From this situation, it is considered that information sharing and exchange with UEM and ISPT in addition to MIREME and INAMI have not been performed sufficiently. Since this project is a collaboration with the Ministry (MIREME), technical skills obtained by cooperative projects should also be shared within the Ministry and the affiliated organizations.

Items to be carried out in the future based on the present situation are summarized as follows.

- To continue to maintain and manage the rock, mineral and chemical laboratory which were enhanced in this project.
- To establish external presence in the field of geology through publication of the results of trainings in this project (enhancement of methods for mineral separation within university, etc.)
- To activate and continue of overseas joint research in the fields of geology, mineralogy, and geophysics, to which current teachers have been studying abroad
- To select and secure experimental equipment to be installed in the future based on joint research with overseas universities
- To activate and continue appeals for the significance of related education and research for an acquisition of the budget on the equipment installation.
- To collaborate with teachers in UEM, who have studied abroad through "Kizauna Program" in Japan
- To cooperate with related organizations such as MIREME

## 5.2 Recommendation for the Future in ISPT

Relevant organization and companies have expected that ISPT will become a provider of personnel resources in the mining-related fields. Although there is no issue with the basic knowledge of the teacher in charge of lecture on the desk in the specialized field, it is necessary to continue to raise the level of knowledge at the practical training and experiment level, which is important as an engineering course, in the future. With regard to the educational background of teachers, the number of teachers who have master or doctor is approximately 1/4 of the total of 40 teachers at present. For this reason, it is first necessary to further upgrade the knowledge of teachers in relation to the education of students.

The content of the revised curriculum has been reviewed at the present time, and the operation of the curriculum is scheduled to commence on next year. In this curriculum, practical training on proximate analysis and coal evaluation method by the Simultaneous Differential Thermogravimetric Analyzer learned by this project are included. Firstly, the continuous utilization and maintenance of this analyzer will be prioritized, and education and practical training by using this instrument will be conducted by making use of the characteristics of Tete area as a coal potential region. As a result, the presence of ISPT will be further improved by responding to the personnel resource needs of related industries.

On the other hand, in order to further supply expert for the coal and other energy industries and to become a hub for related education and research activities as a resource-related university in the future, it is essential to increase the research activities and to further upgrade the related instrument.

Items to be carried out in the future based on the present situation are summarized as follows.

- To continue the maintenance and management of the newly installed Simultaneous Differential Thermogravimetric Analyzer by the Chemical Laboratory
- To establish an external presence in the coal energy field by publishing the results of trainings (about the coal gasification characteristics for occurrence in Tete by using donated analyzer)
- To activate and continue overseas joint research, to which current teachers study abroad, in the fields of coal energy, coal cleaning and mining field, etc.
- To select and secure experimental instrument that needs to be installed in the future based on related basic education and research
- To activate and continue appeals for the significance of related education and research for an acquisition of the budget on the equipment installation.
- To collaborate with teachers in ISPT, who have studied abroad through "Kizauna Program" in Japan
- To cooperate with related organizations such as MIREME

## APPENDIXES

- I) Work Plan
- II) Monitoring Sheet
- III) Minutes of Joint Coordination Committee (JCC) Meeting

## I) Work Plan

**Work plan for the JICA Project on  
Capacity Development in Mineral  
Resources Sector  
Phase 2**

**April 2017**

**JICA Consultants**

**Joint Venture**

**Japan Coal Energy Center (JCOAL)**

**Mitsubishi Materials Techno Co., Ltd. (MMTEC)**

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## 1. Basic Policy for Business Operations

### 1.1. Background

The mineral resources development, mainly the coking coal development in Tete Province and natural gas development in the Rovuma gas field off the coast of Palma located in Cabo Delgado Province, has been making progress with the private companies as a main entity. Presently, high potential is seen even for the metallic mineral resources which have not been developed on large scale, and the potential of future development is expected.

There has been no large-scale development, and there is a lack of knowledge or system in the government institutions about its promotion and management, even though the foreign capital-led development is advancing presently. The surrounding infrastructure, regional development and development of legal system are not making progress and it has become a problem related to progress of resources development. Further, education and human resource development capability of the resources sector in the country itself is low, and due to the lack of engineers in the country and procurement of personnel from overseas even by foreign companies, the resource development is not necessarily linked to the local employment. Therefore, human resource development of government, academia and public that contributes to the sustained development and management of resources to achieve the economic growth is essential.

Under these circumstances, Ministry of Mineral Resources, Mozambique (MIREM) requested the technical cooperation for capability strengthening that focuses on the human resource development of government institutions, universities, and research institutions in the field of resources. Then, survey for developing detailed plan was conducted in March 2014, and R/D (Record of Discussions) was signed in June 2014.

### 1.2. Present condition of higher education in the field of mineral resources in countries to be surveyed

The survey conducted in February 2014 revealed that the original undergraduate course in geology has been restructured and 2 courses on applied geology and map & geological exploration have been started in Department of Geology at The Eduardo Mondlane University. In addition, Masters in Mineral Resources Management course has been started since 2013 with the support from Swedish Agency SIDA and this course has been attended by 15 students. However, experiments or training equipment used in the university are mostly of 1960s and most of them have no signs of being used, and it is believed that the teaching is also centered on classroom learning. Further, the library has some new books, but most of the books are from 1960s to 1970s and the environment is such that those books cannot be fully utilized. The Instituto Superior Politécnico de Tete was established in 2006 with 2 undergraduate courses on Mine Engineering and Ore Processing Engineering in the field of resources, and is the only engineering university in the field of resources in

Mozambique. The university does not offer Masters Course at present and there is no plan to establish it for the time being, considering the weak and premature system. In 2015, the number of students is expected to reach 2,000, which is the present accommodation limit of the system and facilities, and employment of additional teaching staff, development of facilities etc. are the future problems. There are laboratories or practical training rooms but those are not in usable condition since equipments have not been installed there at present. Since the university has opened, no experiments have been conducted at the self-owned facilities, and basically the education is believed to be centered on the classroom learning. The experiments and practical trainings are being implemented through company internship of 1 to 2 months that is imposed on the students. Further, topic of thesis of undergraduate students mainly deals with the coal. The poor library facility has been recognized as a problem and the university intends to improve the books and introduce the library management system. In its present condition, because there are almost no books, the library gives the impression of a building that is mainly used by students for studying or using the terminals.

### 1.3. Objective and implementation items

Among the administrative agency (Ministry of Mineral Resources) and educational institutions (The Eduardo Mondlane University, Instituto Superior Politécnico de Tete), which are the main counter-parts of this project, this operation is applicable to the educational institutions. The objective of this operation is to strengthen the system in educational institutions for acceleration of sustainable mineral resources development and increase the education level of special undergraduate courses to international standard, by developing system and environment for conducting the experiments and practical training such as geological excursion or materials analysis etc. properly at The Eduardo Mondlane University and Instituto Superior Politécnico de Tete. The objective for The Eduardo Mondlane University is to develop geologists who can deal with various fields including natural gas, oil and metallic mineral resources. The objective for the Instituto Superior Politécnico de Tete is to develop human resources who can appropriately conduct the coal analysis and can be employed at the mining industry related companies and can be utilized on the field after graduation.

Among the activities of this project, activities given below will be implemented in this operation, along with the human resource development at the educational institutions.

- Provide guidance on improvement in the curriculum or system of educational and research institutions.
- Provide guidance to human resources of educational and research institutions through model lectures by experts.
- Provide equipment necessary for education and research.
- Provide guidance on the usage and maintenance management method of provided equipment.

This operation will be conducted by dividing the contract period into two phases (Phase 1: 10 months, Phase 2: 44 months) in order to conduct the baseline survey for the result of "improving educational and research capability in the field of mineral resources" and adjust the detailed plan based on the survey results.



## 2. Basic Policy for Operation Implementation

### 2.1 Basic policy

Basic Policy (1)	Development of long-term sustainable program for acceleration of mineral resources development in "Mozambique"
------------------	----------------------------------------------------------------------------------------------------------------

In Mozambique where mineral resources including coal and natural gas are abundant, further development of the country depends greatly on the development of mineral resources. At present, development of mineral resources driven by the foreign capital is in progress, but human resource development along with the development of infrastructure has become a pressing issue. The education for already graduated engineers and geologists including concerned authorities is required under development of human resources, but it is also necessary to improve and upgrade the education at universities to meet the increasing demand for engineers and geologists. In such case, what must be remembered is the strong resources development and growth of resources industry. The consortium having thorough experience in past tragic industrial accidents at coal mines in Japan and measures to overcome those accidents and control mine pollution, will develop a sustainable program for acceleration of mineral resources development with a perspective of accident prevention and mine pollution control. Specifically, in this program, not only the education on knowledge, technology and skills, but also the curriculum that includes social responsibilities of the company will be studied.

Basic Policy (2)	JICA's Implementation Policy (Development of program based on "The Training Program for Human Resources Development in the Mining Sector" or "Position Paper on Mining Industry" etc.)
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It has been already a year since the first foreign student from Mongolia was invited to Akita University. During this period, long-term and short-term training programs in the field of resources have been conducted and steady development has been recognized. The basic policy for this operation also is to conduct on-site and domestic trainings in accordance with the "The Training Program for Human Resources Development in the Mining Sector" and to penetrate (spread) that system based on the policy to give comprehensive support for development of business environment in an integrated manner through collaboration of three groups, which include private sector promoted by JICA, Resources and Energy, and Governance. The following objectives can be given as its contents.

- (1) Systematically develop researchers or administrative agencies in "Mozambique" in the field of resources.
- (2) Bring 200 students to Japanese universities in 10 years and contribute to assistance for getting the degree.
- (3) Develop the human resources with deep understanding of both "Mozambique" that has abundant natural resources and Japan.

On the other hand, educational program will be promoted based on the "Position Paper on Mining

Industry" of JICA. Its perspective is given below (See Figure 2-1).

- (1) Infrastructure and regional development
- (2) Policy Support and legal system development
- (3) Mineral resource management
- (4) Mine safety and environmental measures for Mines

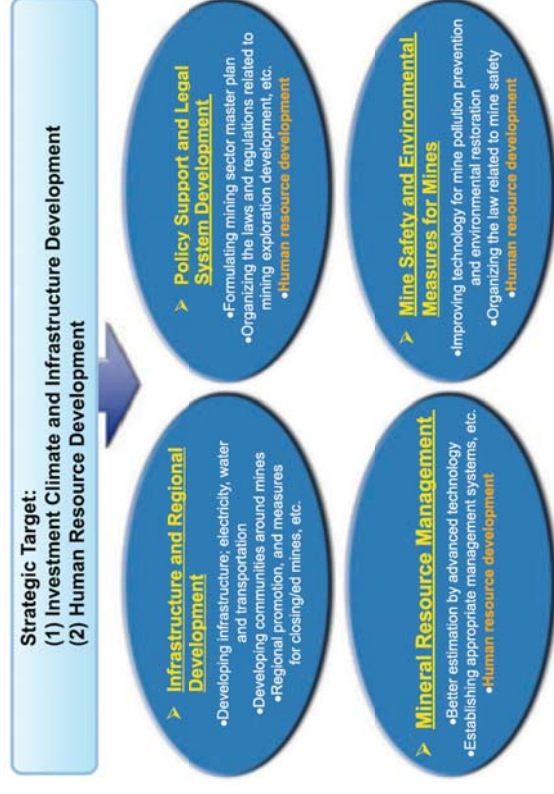


Figure 2-1 Position Paper on Mining Industry

Basic Policy (3)	Study and implementation of training plan that utilizes the resources in Japan to their fullest
------------------	-------------------------------------------------------------------------------------------------

Akita University and The Eduardo Mondlane University have entered into an academic exchange agreement. In addition, Hokkaido University and Kyoto University are accepting long-term trainees from Mozambique universities. The effective training plan will be studied and implemented while seeking cooperation from Hokkaido University and Kyoto University in addition to Akita University, and utilizing the human and physical resources from Japanese Universities, mainly the Akita University. In addition, utilization of resources such as research institutions in the country or prefecture, and research centers of private companies will also be considered.

**Basic Policy (4)**

Reliable support to the field of mineral resources (coal resources, metallic mineral resources, and hydro-carbon resources)

This operation aims to develop geologists at The Eduardo Mondlane University, who can deal with various fields including natural gas, oil, metallic mineral resources and to develop human resources at Instituto Superior Politécnico de Tete, who can appropriately conduct the coal analysis, who can be employed at the mining industry related companies and can be active in the field after graduation. Consequently, broad range of technical fields including coal resources, metallic mineral resources, and hydro-carbon resources (oil, natural gas) will be covered. Further, each technical field will have wide range of technical scope, which includes coal analysis to coal development in the field of coal resources and geological analysis to mine development in the field of mineral resources. Therefore, in this operation, reliable support to the wide range of mineral resources fields will be given by appointing suitable engineers.

**Basic Policy (5)**

Effective and efficient business operation through collaboration with Akita University

Akita University has established the International Center for Research and Education on Mineral and Energy Resources in October 2009 as the university-wide organization, which serves as the base for resources engineering, and has established Faculty of International Resource Sciences in 2014, with an aim of contributing to continuous supply of resources to Japan and the world through research and education on resources engineering and has collaborated with many universities across the five continents and has also entered into an academic exchange agreement with The Eduardo Mondlane University. In addition, Akita University has also entered into partnership agreement with JICA in the field of resources in November 2013. As for the execution of this project, it is not only about the cooperation for short-term trainings in Japan and short-term on-site trainings. Since Akita University has many years of know how concerning the use of equipment in university laboratories, the operation will be performed effectively and efficiently through cooperation on selecting the materials to be provided, creating a training plan for utilizing the equipment, and creating a practical training manual on using the equipment and an equipment maintenance control manual.

**3. Method for implementing the Operation**

This operation will be implemented based on the Operation Instructions from JICA, and the flowchart & work schedule for the research activities is shown in Figure 3-1. Further, each item number shown in the

implementation details in the flowchart corresponds to each item of "Operation Implementation Contents" described later.

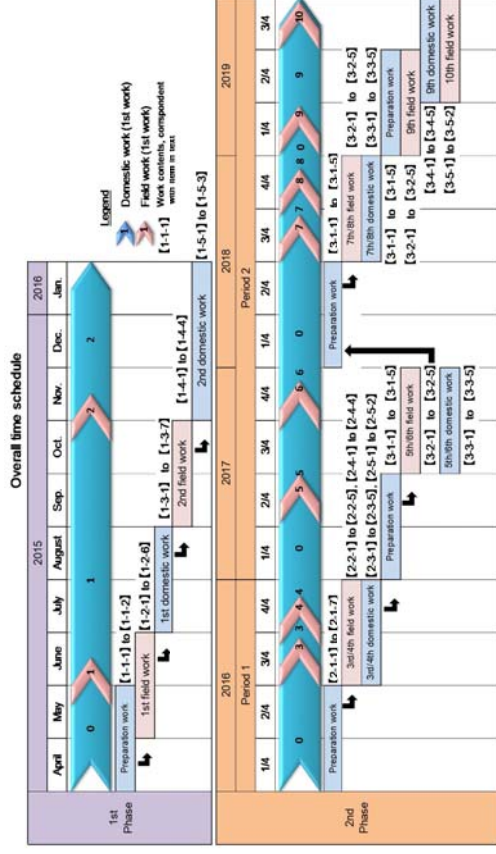


Figure 3-1 Flowchart for Research Activities

**3.1 Operation implementation contents**

**3.1.1 Phase 1 (April 2015 to January 2016)**

**1) Prior domestic work (April-May 2015)**

[Item 1-1-1] Creation of work plan

The basic policy/method for project implementation and work plan etc. will be created and it will be compiled in the Work Plan (Draft) (English) upon discussion with JICA headquarters and Akita University

Based on this plan, the complete picture of this project will be shared through discussion and opinion exchange with Mozambique counterpart. At the same time, its revised version will be created taking into consideration the problems and present state of each activity, and it will be compiled as a work plan and consent will be obtained upon discussion and opinion exchange with concerned people from Mozambique.

The priority areas of The Eduardo Mondlane University and Instituto Superior Politécnico de Tete, which are the assistance targets, will be incorporated in this work plan. The current priority area of The Eduardo Mondlane University is geological science for metallic mineral resources, natural gas and oil. And the current priority area of Instituto Superior Politécnico de Tete is coal resources engineering that reflects the regional characteristics.

However, the priority areas of Instituto Superior Politécnico de Tete are likely to be expanded in future to other resources or fields. Therefore, when compiling the work plan, it is necessary to incorporate such conditions upon thorough discussion with Mozambique counterpart. In addition, it is also necessary to thoroughly consider its relation with support resources and resources securing strategy of Japan when creating the work plan. The above-mentioned points shall be discussed thoroughly with JICA as well.

[Item 1-1-2] Preparation for baseline survey

The baseline survey is about the collaboration with The Eduardo Mondlane University and Instituto Superior Politécnico de Tete, which are the targets of this project, and information required for conducting short-term trainings (Japan and On-site), providing equipment and conducting accompanying trainings at the both the universities will be gathered through discussions with both the universities and other relevant institutions. The preparation for this includes identifying contents of the information to be collected from both the universities and organizing survey items.

The contents assumed at present for information to be organized in advance include the information such as fundamental information, organization, faculties, departments, number of students registered, research contents etc. for The Eduardo Mondlane University and Instituto Superior Politécnico de Tete. The information such as fundamental information, aid contents, aid budget etc. will be collected from the Ministry of Mineral Resources and other donors. The fundamental information such as project and mine development scale, development-type etc. will be collected for the projects such as Revuboe Project and Moatize coal mine etc.

2) Primary On-site Work (May-June 2015)

[Item 1-2-1] Baseline survey

The information required for conducting short-term trainings (Japan and On-site), providing equipment and conducting accompanying trainings at The Eduardo Mondlane University and Instituto Superior Politécnico de Tete will be gathered through discussions with both the universities and other relevant institutions. During information gathering, contents of the information organized during the preparation in advance will be checked and items given in Table 3-1 will be studied.

Table 3-1 Baseline Survey Items

(1) Information about The Eduardo Mondlane University and Instituto Superior Politécnico de Tete
<ul style="list-style-type: none"> <li>• Fundamental information, organization, number of students, number of teachers, budget status, etc.</li> <li>• Creation of list of all the teachers (academic degree status, research background), status of university's research database (storage status of research material such as thesis or references, etc. that can be accessed by the concerned people such as students and teachers, etc. for browsing)</li> <li>• Fundamental information, organization, number of students, number of teachers, companies in which graduated students are employed, curriculum, course information, etc. about the target departments and relevant faculties/departments</li> <li>• Present status of centralized laboratory concept at The Eduardo Mondlane University, present status of analysis of various samples (present analysis has been outsourced to external institutions), etc.</li> <li>• Status of various experiments and practical training at Instituto Superior Politécnico de Tete (Presently being conducted as company intern only), status (system, budget, spare parts, issues, etc.) of owned equipment and its maintenance management, etc.</li> </ul>
(2) Information about Ministry of Mineral Resources and other donors
<ul style="list-style-type: none"> <li>• As a status of assistance to the target departments, the status of equipment such as microscope (polarization, reflection, entity, etc.), which is an equipment related to geological survey, and field survey equipment (hammer, dino-compass etc.) provided by Ministry and other donors</li> <li>• Status of cooperation from Swedish International Development Cooperation Authority (SIDA) (Status of provision of the above-mentioned equipment related to geological survey)</li> <li>• Status of support and equipment provision from private companies (including the support to Instituto Superior Politécnico de Tete from Vale Company)</li> </ul>
(3) Information about Revuboe Project and other projects such as Moatize coal mine
<ul style="list-style-type: none"> <li>• Need for development of human resources for Revuboe Project and at the mine development sites such as Moatize coal mine (Conduct mine inspection, survey and interviews/discussions with the operation companies at the time of this baseline survey)</li> <li>• Possibility of conducting geological inspection, field survey and research at the mine development site</li> </ul>

Further, information will be thoroughly shared with Akita University during this survey.

The results of this survey will be summarized as a baseline report, and draft for the same report will be attached with the Monitoring Sheet that will be submitted later in September 2015.

[Item 1-2-2] Discussion and Agreement on the Work Plan

Regarding the work plan (draft) that has been compiled based on the discussions with JICA headquarters and Akita University held during the preparation, discussion and opinion exchange meeting will be held with the concerned people including Ministry of Mineral Resources, The Eduardo Mondlane University and Instituto Superior Politécnico de Tete. From this, the overall picture of the project will be shared with Mozambique counterpart. At the same time, revised version of work plan (draft) will be created taking into consideration the problems and present status of each activity.

Then, final work plan will be compiled and consent will be obtained, after considering the results of further discussions or opinion exchanges with the concerned people from Mozambique and result of the above-mentioned baseline survey.

Information concerning the project details and how to confirm progress using the Monitoring Sheet, which will be filled out later on a regular basis, and the method for creating the Sheet will also be incorporated into the work plan.

[Item 1-2-3] Formation of working team

The working team for facilitating the system and environment, in which appropriate experiments or practical training can be conducted at The Eduardo Mondlane University and Instituto Superior Politécnico de Tete in accordance with the baseline survey, will be set up. The priority areas for The Eduardo Mondlane University include natural gas, oil and metallic mineral resources, and geological inspection, geophysical exploration, and sample analysis etc. will be covered for these areas. The priority area for Instituto Superior Politécnico de Tete includes resources such as coal, and geological inspection, evaluation of ore reserves, physical properties, calorific value, moisture content, ash content, and fluidity evaluation etc. will be covered for this area.

The members of the working team basically include the members recommended by Mozambique side, but Mozambique side shall recommend the people to ensure participation of members from the required departments.

[Item 1-2-4] Review on long-term training candidates

The selection of people for long-term training will be done by The Eduardo Mondlane University, Instituto Superior Politécnico de Tete and the Ministry of Mineral Resources. However, it is necessary to recommend the research topics for those training candidates or recommend suitable members to C/P manager of the relevant institutions. Therefore, discussions or interviews will be held with the concerned people regarding the list of candidates and their positions, work experience and possible research topics in the long-term training etc. The list of candidates for long-term training will be created based on the result of interviews and discussions.

After the primary on-site work, discussion on selection of suitable members will be conducted with JICA when necessary, based on the same list.

[Item 1-2-5] Review of participants for short-term training in Japan and confirmation of its schedule

After the primary on-site work, discussion on selection of members for attending the short-term training in Japan and the training schedule will be conducted with The Eduardo Mondlane University, Instituto Superior Politécnico de Tete and the Ministry of Mineral Resources. At that time, participants for this training will be selected. The members will be selected by The Eduardo Mondlane University and Instituto Superior Politécnico de Tete, but the Ministry will make necessary arrangements in order to facilitate the preparatory work, since

time until the training is short. At the same time, regarding the list of participants for short-term training in Japan, concerned people will be interviewed for their position or specialization field and work experience etc., and the information will be shared with Akita University, which is one of the locations for conducting short-term training.

The training participants include members from both the universities ranging from management level to teachers having knowledge about the laboratory status & equipment and junior level members such as laboratory assistants, but the number of members will be approximately 5 since the training will be conducted in Japan.

[Item 1-2-6] Holding of Joint Coordination Committee (JCC) and Technical Coordination Committee (TCC)

The Ministry of Minerals, The Eduardo Mondlane University, Instituto Superior Politécnico de Tete and JICA will hold JCC to check the progress of the project. The work plan will be discussed and the opinions on future policy will be exchanged in the committee meeting. In TCC, the agenda for working team formed during primary on-site work will be discussed.

3) Primary domestic work (June-October 2015)

[Item 1-3-1] Creation of training plan for utilization of equipment in both the universities

The complete training plan from Phase 1 to Phase 2 for utilization of equipment will be created based on the baseline survey or needs etc. from the primary on-site work. This plan will be created after thorough discussion with Akita University, which will be deeply involved in the country-wise trainings (short-term trainings in Japan and short-term training in Mozambique).

The created training plan will be attached with the Monitoring Sheet to be submitted in late September.

[Item 1-3-2] Preparations and implementation of short-term training in Japan

The short-term training in Japan will be coordinated and conducted based on Item 1-2-5. The contents of the training are targeted for the level of members ranging from those managing the research and operations in relevant fields to the level of members involved in practical operations (working) of research or laboratory equipment, and the training will be conducted mainly at Akita University, which has entered into an academic exchange agreement with The Eduardo Mondlane University. The training contents and schedule will be planned after thoroughly considering such conditions, and trainees will be invited upon coordination with the concerned people from Mozambique and Japan regarding its implementation.

As the training contents are wide-ranging, research institutions in Japan such as National Institute of Advanced Industrial Science and Technology (AIST) or resources such as private mines will also be utilized as training target in addition to Akita University. At that time, inspection of laboratory, library, lectures (model lectures) etc. conducted at the Akita University, explanation of activities or curriculum of the said university, discussion on contents of collaboration with The Eduardo Mondlane University and Instituto Superior

Politécnico de Tete, teachers and students exchange etc. shall be included in the training at Akita University.  
The plan for the short-term training in Japan assumed in the present situation is shown in Table 3-2.

Table 3-2 1<sup>st</sup> Short-Term Training in Japan, Phase 1 (Plan)

		Training content	Remarks
The 1 <sup>st</sup> day	Sat.	Maputo → Johannesburg → Hong Kong	
The 2 <sup>nd</sup> day	Sun.	Hong Kong → Tokyo → Akita	
The 3 <sup>rd</sup> day	Mon.	Mining short-term lecture (Upper stream: exploration)	Akita University
The 4 <sup>th</sup> day	Tues.	Mining short-term lecture (Upper stream: Mine development, dressing)	Akita University
The 5 <sup>th</sup> day	Wed.	Mining short-term lecture (Lower stream: environment)	Akita University
The 6 <sup>th</sup> day	Thur.	Mining short-term lecture (Lower stream: mining economy)	Akita University
The 7 <sup>th</sup> day	Fri.	Mining short-term lecture (summary)	Akita University
The 8 <sup>th</sup> day	Sat.	Akita → Tokyo	
The 9 <sup>th</sup> day	Sun.	Holiday	
The 10 <sup>th</sup> day	Mon.	Briefing Program Orientation	
The 11 <sup>th</sup> day	Tues.	Visiting: JICA, Embassy of Mozambique, JCOAL, IMITEC, Japanese company expanding business in Mozambique	
The 12 <sup>th</sup> day	Wed.	Tokyo → Sapporo	
The 13 <sup>th</sup> day	Thur.	Open cut mine	Hokkaido
The 14 <sup>th</sup> day	Fri.	Gas field	Hokkaido
The 15 <sup>th</sup> day	Sat.	Sapporo → Tokyo → Kyoto	
The 16 <sup>th</sup> day	Sun.	Holiday	
The 17 <sup>th</sup> day	Mon.	Visiting (Analysis equipment manufacturer ) Kyoto → Tokyo	Kyoto
The 18 <sup>th</sup> day	Tues.	Advanced Industrial Science and Technology (ABST)	around Tokyo
The 19 <sup>th</sup> day	Wed.	Visiting (an iron works and coal analysis facility)	around Tokyo
The 20 <sup>th</sup> day	Thur.	Discussion about equipment to be provided Preparation for reporting session	
The 21 <sup>th</sup> day	Fri.	Reporting session	
The 22 <sup>th</sup> day	Sat.	Tokyo → Hong Kong → Johannesburg	
The 23 <sup>th</sup> day	Sun.	Johannesburg → Maputo	

[Item 1-3-3] Implementation of assistance for long-term trainees

In addition, 4 members (1 teacher from Instituto Superior Politécnico de Tete, 1 teacher from The Eduardo Mondlane University, and 2 administrative officers from the Ministry of Mineral Resources) from Mozambique are presently in Japan for the long-term training under the training program for human resources development in the mining sector since last year. Regarding the participation of same 4 members in the short-term training, it shall be considered or coordinated upon discussion with JICA or concerned people. At that time, opinions on assistance related needs, training related requirements will be exchanged through communication with the

same long-term trainees as well.

If it is found after exchanging opinions that it is necessary to get samples necessary for the research by long-term trainees, assistance on research by long-term trainees, such as necessary coordination with the on-site universities to which trainees belong, it will be provided when necessary.

[Item 1-3-4] Creation and submission of Monitoring Sheet (Late September 2015)

The Monitoring Sheet as prescribed by JICA will be created jointly with the implementing body. For creating Monitoring Sheet, prior discussion will be held with the implementing body from Mozambique during the primary on-site survey, and time for its actual creation based on mail etc. will be provided even during the short-term training in Japan. At that time, changes from PDIM, PO agreed upon at the time of signing R/D will be checked with the implementing body when starting the item and Monitoring Sheet Ver.1 will be created based on that.

The Monitoring Sheet will be created and submitted after thorough discussion with JICA as well as concerned people from Japan, baseline survey report (draft version) and plan for training on utilization of equipment will be attached to the Monitoring Sheet to be submitted.

[Item 1-3-5] Preparation for on-site short-term training

As a preparation for the on-site short-term training that will be conducted in secondary on-site work, training contents and schedule planning, coordination of participants etc. will be conducted. These contents will be created under the cooperation with Akita University, but the plan will be created upon acknowledging the problems and needs of the destination in baseline survey, short-term training in Japan conducted up to the above-mentioned item. The contents shall include formulation of equipment maintenance management plan and practical training plan based on the objective and expected results of this project, education on mining industry in Japan, inspection of laboratories, libraries and lectures (model lectures) at both the universities, conducting special lectures (model lectures) from Japan, joint lectures and workshops with the universities from Mozambique, discussion on collaboration plan concerning equipment provision and laboratory ideas, teachers and students exchange etc. The plan or schedule will be created considering the fact that the eligible members for the training are wide-ranging which include teachers and students from The Eduardo Mondlane University and Instituto Superior Politécnico de Tete.

[Item 1-3-6] Identification of equipment to be procured

The equipment required for setting up the system and environment, where experiments and practical work such as geological inspection or sample analysis etc. can be conducted properly, will be identified based on the baseline survey, short-term training in Japan and the discussion with Akita University.

At present, equipment for creating thin sample and conducting analysis are needed at The Eduardo Mondlane University in particular. Regarding this point, it is considered that the procurement of said equipment

is appropriate even in consideration of the current budget, but equipment will be identified in consideration of the resources such as Akita University that is cooperating in prior baseline survey, short-term trainings in Japan or on-site short-term trainings etc. and ease of maintenance management on the site.

[Item 1-3-7] Prior creation of equipment utilization training manual (draft) and equipment maintenance management manual (draft)

In the on-site short-term training, utilization training plan and maintenance management plan for the equipment identified and procured in above-mentioned Item 3-5 will be developed. Pertaining to this, these manuals (draft) will be created in the said on-site short-term training. The draft will be created in advance before the secondary on-site work, since creating draft during the training is time-critical. The advice from Akita University or research institutions shall be taken for its creation.

The creation of practical training and equipment maintenance management manual and training the students based on these manuals is directly linked to the improvement in curriculum or system at both the universities. Therefore, manuals shall be created such that its contents will lead to highly effective curriculum and geology, mineral resources can be studied systematically in a specialized way. Further, clarification on involvement of teachers or students and companies related to practical training or equipment maintenance within the manual will lead to continuous system maintenance.

#### 4) Secondary on-site work (October-November 2015)

[Item 1-4-1] Conducting on-site short-term training

The on-site short-term training will be aligned and conducted based on Items 1-3-4 and 1-3-5. When conducting the training, present resources of The Eduardo Mondlane University and Instituto Superior Politécnico de Tete will be utilized and training will be conducted based on Items 1-3-5 to 1-3-7 implemented in preparatory work of this training during primary domestic work.

The field training will be included in this training, from the perspective of facilitating development of field geologists at The Eduardo Mondlane University, who can deal with the oil, gas and mineral resources on the field and facilitating development of human resources at Instituto Superior Politécnico de Tete, who can carry out coal interpretation, which is also the project objective. The target field will be the coal field in Tete Province where the Instituto Superior Politécnico de Tete is located.

The on-site short-term training plan assumed in the present situation is given in Table 3-3.

Table 3-3 1<sup>st</sup> Short-term training in Mozambique (Plan)

		Training content	Remarks
The 1st day	Mon.	Meeting for holding JCC Meeting and preparation for event	MREM Eduardo Mondlane University
The 2nd day	Tues.	Model lecture	Eduardo Mondlane University
The 3rd day	Wed.	Special lecture	Eduardo Mondlane University
The 4th day	Thur.	Discuss and consultation about equipment maintenance	Eduardo Mondlane University
The 5th day	Fri.	JCC	Eduardo Mondlane University
The 6th day	Sat.	Holiday	
The 7th day	Sun.	Maputo—Tete	
The 8th day	Mon.	Field coursework	in Tete
The 9th day	Tues.	Field coursework	in Tete
The 10th day	Wed.	Special lecture	Tete Polytechnic Institute for Higher Education
The 11th day	Thur.	Workshop	Tete Polytechnic Institute for Higher Education
The 12th day	Fri.	Discuss and consultation about equipment maintenance Tete—Maputo	

Further, information such as on-site training mentioned earlier shall be thoroughly shared with the concerned people from Akita University from preparatory stage, since there is a possibility of collaboration with them even during the secondary on-site work.

[Item 1-4-2] Review of equipment utilization training manual (draft) and equipment maintenance management manual (draft)

Regarding manuals (draft) concerning utilization training plan and maintenance management plan for the equipment created in Item 1-3-7, training and discussion shall be conducted using the contents of short-term training in Mozambique in the above-mentioned Item 1-4-1. In addition, final manual (draft) for Phase 1 shall be reviewed based on the feedback from actual resources and trainees from both the universities.

[Item 1-4-3] Establishment of acceptance system related to procurement of equipment

The procurement of equipment to be provided will be done after planning of Phase 2. Therefore, actual deployment of equipment at the universities will be done before the tertiary on-site survey. It is extremely important to establish the acceptance system at the time of acceptance of equipment for their smooth operation after deployment. Consequently, to establish the equipment acceptance system at the time of this

survey, work contents after acceptance will be discussed and confirmed in collaboration with the working team formed during the primary on-site work for setting up the system and environment where appropriate experiments and practical training can be conducted.

[Item 1.4-4] Review of long-term training candidates

The selection of members for long-term training will be considered in continuation with the primary on-site work. In this selection, series of trainings including short-term trainings in Japan or short-term training in Mozambique conducted so far, current needs of Mozambique etc. will also be discussed.

The list of long-term training candidates will be created based on the result of interviews and discussions. After secondary on-site work, discussion on appropriate candidate selection will be held with JICA when necessary.

5) The second domestic work (November 2015 to January 2016)

[Item 1.5-1] Review of equipment utilization training manual (draft) and equipment maintenance management manual (draft)

Regarding both the manuals (draft) that have been reviewed in Item 1.4-2 of the second on-site work, the concept of manuals as of Phase 1 will be created.

[Item 1.5-2] Creation of procurement plan for the provision of equipment

The specifications of selected equipment and procurement plan regarding quantity etc. will be created in consideration of the procurement of equipment to be provided in Phase 2. The current budget is 15 million yen and procurement plan will be created within that budget.

[Item 1.5-3] Discussion and creation of phase 2 activity plan (draft)

The activities of phase 2 include procurement of equipment to be provided, conducting training on equipment utilization and maintenance management, considering and conducting country-wise training (short-term trainings in Japan and short-term training in Mozambique). Regarding the contents of these activities, plan (draft) for the activities of Phase 2 will be created in the sequence of development from Phase 1, based on the progress of working team's action items that were implemented or created in Phase 1, plan for training on equipment utilization, manual (draft) for conducting equipment utilization training and equipment maintenance management manual (draft).

The plan will be created after thorough discussion with Akita University, which is participating in the research etc. and JICA.

[Item 1.5-4] Creation of final report on Phase 1 activities

The final report on Phase 1 activities will be created through organizing and summarizing the contents of Phase 1.

3.1.2 Phase 2 - Part 1 (February 2016 to December 2016)

1) Preliminary domestic work (February - August 2016)

[Item 2.1-1] Drawing up of phase 2 course of action

The phase 2 course of action will be created through discussion with Akita University and JICA in the sequence of phase 2 activity plan (draft) described in item 1.5-3 of Phase 1. In this process opinion exchange with Mozambique counterpart will also be made by mail. And accordingly the working plan which was made in phase 1 will be revised.

[Item 2.1-2] Consideration and planning of country-wise trainings (coal policy training, short-term trainings in Japan and in Mozambique)

The content of country-wise trainings (coal policy training, short-term trainings in Japan and in Mozambique) held during Phase 2 - Part 1 will be considered and planned. The trainings are basically similar to the ones in Phase 1, however, training of using the laboratory equipment procured shall be included. And furthermore the need of Mozambique side for trainings will be reconsidered. And then, planning of the trainings should be done through discussions with Akita University.

[Item 2.1-3] Procurement of laboratory equipment provided by JICA

About the selected equipment in Phase 1, the procurement of equipment will be made based on the specifications and quantity created in Phase 1.

[Item 2.1-4] Creation and submission of Monitoring Sheet (Late March 2016)

The Monitoring Sheet as prescribed by JICA will be created jointly with the implementing body. For creating Monitoring Sheet, prior discussion will be held with the implementing body in Mozambique during the 2<sup>nd</sup> short-term training in Mozambique, and its actual creation will be based on mail etc.

The Monitoring Sheet will be created and submitted after thorough discussion with JICA as well as concerned body in Japan.

[Item 2.1-5] Preparations and implementation of coal policy training

The preparation for the coal policy training will be conducted on training contents and schedule planning, coordination of participants etc.

The plan for the coal policy training is shown in Table 3-4.

Table 3-4 Coal Policy Training

Date	Type	Contents	Company or Organization
May/22(Sun)		Arrival at Nairita	
May/23(Mon)		Briefing of Provisions	JICA
May/24(Tue)	visit	Orientation of Training Program	JCOAL
May/25(Wed)	lecture	Courtesy calls (METI, NEDO, Embassy of the Republic of Mozambique, JOGMEC, JCOAL)	
May/26(Thu)	lecture	Coal Development and Environmental Protection	JCOAL
May/27(Fri)	lecture	Clean Coal Technology	JCOAL
May/28(Sat)	lecture	Introduction to Mining Law	JCOAL
May/29(Sun)	lecture	F/S of Coal Mine Development	JCOAL
May/30(Mon)	visit	Courtesy calls (JICA Headquarter)	JICA
May/31(Tue)	move	Holiday Traveling: Tokyo to Kushiro	
Jun/1(Wed)	tour	Underground Coal Mine & Coal Preparation Plant	Kushiro Coal Mine (KCM)
Jun/2(Thu)	move	Traveling: Kushiro to Sapporo	
Jun/3(Fri)	visit	Courtesy Calls (METI Hokkaido Bureau of Economy, Trade and Industry; METI Hokkaido Industrial Safety and Inspection Department)	
Jun/4(Sat)	tour	Open-pit Coal Mine	Ibatai Coal Mine, Hokuryo Saingyo
Jun/5(Sun)	tour	Regeneration of coal from coal washing waste	Town Development Planning Department, Yubari City
Jun/6(Mon)	lecture	Filing and Administration of Mining rights (Mining Property)	METI Hokkaido Bureau of Economy, Trade and Industry
Jun/7(Tue)	tour	Application and Supervision of Management Plan for Mining Operation	Hokkaido Univ.
Jun/8(Wed)	lecture	Mine Safety Act: Prevention of Injury	METI Hokkaido Industrial Safety and Inspection Department
Jun/9(Thu)	lecture	Mine Safety Act: Preservation of Mining-induced Pollution	
Jun/10(Fri)	move	Traveling: Sapporo to Tokyo	
Jun/11(Sat)	Holiday		
Jun/12(Sun)	Holiday		
Jun/13(Mon)	tour	Iron Mill Coal Analysis Facilities	Kimitsu Works, Nippon Steel & Sumitomo Metal
Jun/14(Tue)	tour	Coal Bulk Terminal	Coal & Environment Research Laboratory, Idemitsu Kosan Co., Ltd.
Jun/15(Wed)	tour	Coal Fired Power Plant	Jageo Power Plant, JPOWER
Jun/16(Thu)	tour	Sankein Garden	
Jun/17(Fri)	tour	Traveling: Tokyo to Hakata	
Jun/18(Sat)	tour	Tagawa City Coal Mining Historical Museum	
Jun/19(Sun)	lecture	Rehabilitation of Environmental Destruction due to mining	Kyushu Bureau of Economy, Trade and Industry
Jun/20(Mon)	move	Traveling: Hakata to Kitakyushu	
Jun/21(Tue)	tour	Kitakyushu Eco Town	Kitakyushu Ecotown Center
Jun/22(Wed)	tour	Limestone Mine	Higashidani Mine, Mitsubishi Materials Corporation
Jun/23(Thu)	tour	Cement Factory	Kyushu Plant, Mitsubishi Materials Corporation
Jun/24(Fri)	move	Traveling: Kitakyushu to Tokyo	
Jun/25(Sat)	Holiday		
Jun/26(Sun)	Holiday		
Jun/27(Mon)	lecture	Economic Analysis	Nippon Steel & Sumitomo Metal
Jun/28(Tue)	lecture	Coal Reserve and Resources	Mitsubishi Materials Techno Corporation
Jun/29(Wed)	lecture	The local community's relationship and mining development	Japan Mining Engineering & Training Center
Jun/30(Thu)	move	Move Tokyo to Izu	
Jul/1(Fri)	tour	Mining Machinery Manufacturer	KOMATSU Technical Training Center
Jul/2(Sat)	move	Move Izu to Tokyo	
Jul/3(Sun)		Evaluation Meeting	JCOAL
Jul/4(Mon)		Drawing Up of Action Plan Report	JICA
Jul/5(Tue)		Action Plan Report	JCOAL
Jul/6(Wed)		Completion Ceremony of the Training	
Jul/7(Thu)		Departure from Nairita	

[Item 2-1-6] Preparation for short-term training in Mozambique

As a preparation for the short-term training in Mozambique that will be conducted in the 3rd on-site work, training contents and schedule planning, coordination of participants etc. will be conducted. The content of the training will be focused on equipment utilization training and equipment maintenance management. These contents will be created under the close cooperation with Akita University. And, the need of Mozambique side for trainings will be also considered.

[Item 2-1-7] Preparation for Joint Coordination Committee (JCC)

JCC meeting will be held during the 3rd on-site work to review the progress of the project. So, preparation for the meeting will be conducted on such as revision of working plan, summary of the status of procurement of laboratory equipment provided by JICA for UEM and ISPT and etc.

2) The 3rd On-site Work (August-September 2016)

[Item 2-2-1] Check of the condition of laboratory equipment procured

The condition of laboratory equipment provided by JICA will be checked for properly set and operational. Checking work will be done jointly with working teams of UEM and ISPT. If any flaw is detected, the necessary correcting measures shall be issued.

The equipment for preparation of chemical analysis and pre-interpretation of geological survey were selected as donated items for The Eduardo Mondlane University on the Phase 1 in this project. On the other hand, the equipment for a coal-related proximate analysis was selected as a donated item for Instituto Superior Politécnico de Tete.

[Item 2-2-2] Conducting the 2nd short-term training in Mozambique

The 2nd short-term training in Mozambique will be conducted in similar way as the one held in Phase 1. However, the content of the training will be focused on equipment utilization training and equipment maintenance management using laboratory equipment procured.

The training plan is shown in Table 3-5.



Table 3-5 2<sup>nd</sup> Short-term Training in Mozambique

Date	week	Ivent	Stay
8/27	Sat	Narita→Hong Kong→	Flying overnight
8/28	Sun	→Johannesberg→Maputo	Maputo
8/29	Mon	Courtesy call (MIREME, Embassy of Japan)	Maputo
8/30	Tue	Courtesy call (JICA)	Maputo
8/31	Wed	Meeting and Inspection of laboratories (UEM)	Maputo
9/1	Thu	Instruction of thin section preparation (UEM)	Maputo
9/2	Fri	Special lecture (UEM)	Maputo
		JCC (Joint Coordination Committee) (MIREME)	
		Wrap-up meeting (UEM)	Maputo
9/3	Sat		Maputo
9/4	Sun	Maputo→Tete	Tete
9/5	Mon	Meeting and Inspection of Equipment (ISPT)	Tete
9/6	Tue	Setting and operation checking of equipment (ISPT)	Tete
9/7	Wed	Instruction of coal analysis (ISPT)	Tete
9/8	Thu	Special lecture and instruction of coal analysis (ISPT)	Tete
9/9	Fri	Wrap-up meeting (ISPT)	Tete
		Tete →Maputo	
9/10	Sat	Wrap-up meeting (JICA)	Maputo
9/11	Sun	Maputo →Johannesberg → →Hong Kong→Narita	Flying overnight

[Item 2-2-3] Creation of equipment utilization training manual and equipment maintenance management manual

Creation of he equipment utilization training manual and equipment maintenance management manual will be started by laboratory technical staff and lecturers in charge on their own initiative at each university based on the contents considered during Phase 1.

[Item 2-2-4] Holding of the 2<sup>nd</sup> Joint Coordination Committee (JCC) meeting

JCC meeting will be held to review the progress of the project. The revised work plan will be discussed and the opinions on future policy will be exchanged in the committee meeting. And the present condition of the working group in the universities about connection with arrangement of the equipment will be also discussed by JCC.

[Item 2-2-5] Review of long-term training candidates

The selection of members for long-term training will be considered in continuation with Phase 1.

The list of long-term training candidates will be created based on the result of interviews and discussions. When necessary, discussion on appropriate candidate selection will be held with JICA.

3) The 3rd domestic work (September-October 2016)

[Item 2-3-1] Creation of equipment utilization training manual (draft) and equipment maintenance management manual (draft)

Regarding both the manuals (draft), of which creation work has been started in Item 2-2-3 of the 3<sup>rd</sup> on-site work, creation work will be substantially progressed during the experimental training in Akita University of 2<sup>nd</sup> short-term training in Japan.

[Item 2-3-2] Creation and submission of Monitoring Sheet (Late September 2016)

The Monitoring Sheet as prescribed by JICA will be created jointly with the implementing body. For creating Monitoring Sheet, prior discussion will be held with the implementing body in Mozambique during the 2<sup>nd</sup> short-term training in Mozambique, and its actual creation will be based on mail etc.

The Monitoring Sheet will be created and submitted after thorough discussion with JICA as well as concerned body in Japan.

[Item 2-3-3] Preparations and implementation of short-term training in Japan

The short-term training in Japan will be coordinated and conducted. The participants of the training are targeted for the lectures and laboratory staff involved in practical operations of research or laboratory equipment, and the lectures involved in curriculum improvement work at both universities. And, the training will be conducted mainly at Akita University, which has entered into an academic exchange agreement with The Eduardo Mondlane University. Training also will be held at other universities and mine site at etc.

The training are focused on the practical training in the laboratories of Akita University and on providing guidance on improvement in the curriculum of university.

The training contents and schedule will be planned after thoroughly considering such conditions, and trainees will be invited upon coordination with the concerned people from Mozambique and Japan regarding its implementation.

The training plan is shown in Table 3-6.

Table 3-6 2<sup>nd</sup> Short-term Training in Japan

		Training content	Remarks
Sept. 24	Sat.	Maputo → Johannesburg → Hong Kong	
Sept. 25	Sun.	Hong Kong → Tokyo	
Sept. 26	Mon.	Orientation by JICA Courtesy call (JICA) Tokyo → Akita	JICA Head quarter
Sept. 27	Tues.	Orientation Campus tour	Akita University
Sept. 28	Wed.	Thin section preparation training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
Sept. 29	Thur.	Thin section preparation training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
Sept. 30	Fri.	Thin section preparation training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
Oct. 1	Sat.		
Oct. 2	Sun.		
Oct. 3	Mon.	Thin section preparation training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
Oct. 4	Tues.	Thin section preparation training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
Oct. 5	Wed.	Thin section preparation training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
Oct. 6	Thur.	Thin section preparation training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
Oct. 7	Fri.	Thin section preparation training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
Oct. 8	Sat.		
Oct. 9	Sun.		
Oct. 10	Mon.	T: Akita → Sapporo L: Holiday	
Oct. 11	Tues.	T: Hokkaido University L: Training & Manual drawing-up	Hokkaido University Akita University
Oct. 12	Wed.	T: Visiting (open-cut coal mine) L: Training & Manual drawing-up	Bibai or Tomakomai Akita University
Oct. 13	Thur.	T: Tokyo University L: Training & Manual drawing-up	Tokyo University Akita University
Oct. 14	Fri.	T: Visiting (an iron works and coal-fired power station) L: Training & Manual drawing-up	Kimitsu & Isogo Akita University
Oct. 15	Sat.	T: Tokyo → Kyoto	
Oct. 16	Sun.		
Oct. 17	Mon.	T: Kyoto University L: Training & Manual drawing-up	Kyoto University Akita University
Oct. 18	Tue	T: Visiting (Analysis equipment manufacturer ) Kyoto → Fukuoka L: Training & Manual drawing-up	Kyoto Akita University
Oct. 19	Wed	T: Kyushu University Fukuoka → Tokyo L: Training & Manual drawing-up	Kyushu University Akita University
Oct. 20	Thu	Discussion between trainees and consultant Preparation for reporting session	JICA Tokyo
Oct. 21	Fri	Reporting session	JICA Tokyo
Oct. 22	Sat	Tokyo → Hong Kong → Johannesburg	
Oct. 23	Sun.	Johannesburg → Maputo	

※ T: Teacher (Professor or Lecturer)  
L: Laboratory staff (Head or Technician)

[Item 2-3-4] Implementation of assistance for long-term trainees

Regarding the participation of current long-term trainees in the short-term training, it shall be considered or coordinated upon discussion with JICA and concerned people. Addition to such accommodation, through communication with long-term trainees, for example, assistance on research for long-term trainees will be provided when necessary.

[Item 2-3-5] Preparation for short-term training in Mozambique

As a preparation for the short-term training in Mozambique, training contents and schedule planning, coordination of participants etc. will be conducted. The content of the training will be focused on equipment utilization training and equipment maintenance management. These contents will be created under the close cooperation with Akita University. And, the need of Mozambique side for trainings will be also considered.

The contents shall include conducting special lectures such topics on geology, coal analysis, mineral deposit, mining. The field training will be also included in this training.

4) The 4th On-site Work (October-November 2016)

[Item 2-4-1] Confirmation of installation of laboratory equipment provided by JICA

The condition of laboratory equipment provided by JICA will be checked for property set and operational. Checking work will be done jointly with working teams of UEM and ISPT.

The equipment for preparation of chemical analysis and pre-interpretation of geological survey were selected as donated items for The Eduardo Mondlane University on the Phase 1 in this project. On the other hand, the equipment for a coal-related proximate analysis was selected as a donated item for Instituto Superior Politécnico de Tete.

[Item 2-4-2] Conducting of short-term training in Mozambique

The 3rd short-term training in Mozambique will be conducted in similar way as the previous ones. However, the content of the training will be focused on equipment utilization training and equipment maintenance management using laboratory equipment procured. Special lectures of such topics on geology, coal analysis, mineral deposit, mining, will be conducted. The field training will be also included in this training.

The training plan is shown in Table 3-7.

Table 3-7 3<sup>rd</sup> Short-term Training in Mozambique

	Training content	Remarks
The 1st day	Mon. Instruction of coal analysis	ISPT
The 2nd day	Tues. Instruction of coal analysis	ISPT
The 3rd day	Wed. Special lecture	ISPT
The 4th day	Thur. Field coursework	in Tele
The 5th day	Fri. Wrap-up Meeting	ISPT
The 6th day	Sat. Tele-Maputo	
The 7th day	Sun. Holiday	
The 8th day	Mon. Courtesy call (MIREME, Japan Embassy, JICA)	
The 9th day	Tues. Thin section preparation training	UEM
The 10th day	Wed. Thin section preparation training	UEM
The 11th day	Thur. Special lecture	UEM
The 12th day	Fri. Wrap-up Meeting	UEM

[Item 2-4-3] Creation of equipment utilization training manual (draft) and equipment maintenance management manual (draft)

Regarding both the manuals (draft), of which creation work has been started as described in Item 2-2-3 of the 3<sup>rd</sup> on-site work, revision and updating work will be further progressed through the experimental training in Akita University of 2<sup>nd</sup> short-term training in Japan.

[Item 2-4-4] Review of long-term training candidates

The selection of members for long-term training will be considered in continuation with Phase 1.

The list of long-term training candidates will be created based on the result of interviews and discussions.

After 4th on-site work, discussion on appropriate candidate selection will be held with JICA when necessary.

5) The 4th domestic work (November 2016 to January 2017)

[Item 2-5-1] Creation of equipment utilization training manual (draft) and equipment maintenance management manual (draft)

Both the manuals (draft), which have been created by laboratory technical staff and lecturers in charge on their own initiative at each university, will be compiled as the manuals (draft) at the time of phase 2 - part 1.

[Item 2-5-2] Discussion and creation of course of work of phase 2 - part 2

Activities of the Phase 2 consist of the procurement of equipment provided by JICA, conducting the short-term training for equipment utilization and equipment maintenance management, and reviewing and then conducting of country-wise trainings (short-term training in Japan and short-term training in Mozambique). Based on the progress of action plan created by the working team on the Phase 1, and the program of short-term training for the equipment utilization, the draft manuals for the equipment utilization and the draft manual for the equipment maintenance management, the activities for Phase 2 – part 2 will be planned by expanding those of Phase 1 and Phase 2 – part 2.

The program will be created after thorough discussion with Akita University and JICA.

3.1.3 Phase 2 - Part 2 (January 2017 to September 2019)

Phase 2 - Part 2 is Second Step of the Phase 2 .

Procurement and installation of equipment in respect of the technical transfer are performed by the end of 2016 on the Phase 2 and the operation will be also commenced on the same period. Therefore, the contents for technical transfer after 2017 of this Phase will be shifted to specialized area where the rise to the international standards of an education level for both universities is expected to reach by using the equipment procured in Phase 2. This will help for universities to instruct students to educate through own research activity.

On the other hand, it is also well expected that the environments surrounding the performance of the Mozambique side and the progress of this project become altered. In that case, the content of technical transfer in this project will be added and changed flexibly. In such case, involved parties in Japanese side discuss the direction of the project based on the actual progress and result at the time.

Basic schedule of activities in this project is similar for almost every year. However, the contents are needed to be considered according to a situation of the performance and environment surrounding project at the time. The contents planned for 33 months throughout the month of January 2017 until late September 2019 are shown briefly as follows;

1) Preliminary domestic work (January-June 2017, January-June 2018, January-May 2019)

[Item 3-1-1] Drawing up of course of action for each year of phase 2-part 2

The course of action will be created for each year of phase 2-part 2, and accordingly the working plan will be revised.

[Item 3-1-2] Consideration and planning of country-wise trainings (short-term trainings in Japan and in

Mozambique

The content and schedule of country-wise trainings (short-term training in Japan (once a year) and short-term trainings in Mozambique (twice a year)) for each year will be considered and planned.

[Item 3-1-3] Creation and submission of Monitoring Sheet (Late March 2017, 2018 and 2019)

The Monitoring Sheet as prescribed by JICA will be created jointly with the implementing body, and be submitted after thorough discussion with JICA as well as concerned body in Japan.

[Item 3-1-4] Preparation for short-term training in Mozambique

As a preparation for the short-term training in Mozambique, training contents and schedule planning, coordination of participants etc. will be conducted.

[Item 3-1-5] Preparation for Joint Coordination Committee (JCC)

JCC meeting will be held once a year during on-site work. So, preparation for the meeting will be conducted on such as revision of working plan.

2) The 5<sup>th</sup>, 6<sup>th</sup>, 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> on-site work in Mozambique (May 2017, October-November 2017, May-June 2018, October-November 2018, May 2019)

[Item 3-2-1] Conducting of short-term training in Mozambique

The short-term training in Mozambique will be scheduled and conducted in similar way as the previous ones. The training plan of 4<sup>th</sup> short-term training in Mozambique is shown in Table 3-8.

Table 3-8 4<sup>th</sup> Short-term Training in Mozambique

Date	week	Event	Slay
5/15	Mon	Courtesy call (Embassy of Japan) JCC (Joint Coordination Committee) Meeting (JICA)	Maputo
5/16	Tue	Meeting and Inspection of laboratories (UEM) Setting and operation checking of equipment (UEM)	Maputo
5/17	Wed	Instruction of operation of equipment provided (UEM)	Maputo
5/18	Thu	Special lecture (UEM)	Maputo
5/19	Fri	Wrap-up meeting (UEM)	Maputo
5/20	Sat		Maputo
5/21	Sun	<i>Maputo → Tete</i>	Tete
5/22	Mon	Meeting and Inspection of Equipment (ISPT)	Tete
5/23	Tue	Instruction of coal analysis (ISPT)	Tete
5/24	Wed	Field study (Moatize area, ISPT)	Tete
5/25	Thu	Special lecture and Instruction of coal analysis (ISPT)	Tete
5/26	Fri	Wrap-up meeting (ISPT)	Tete
		<i>Tete → Beira → Maputo</i>	Maputo

[Item 3-2-2] Revision of equipment utilization training manual (draft) and equipment maintenance management manual (draft)

Contents of both the manuals (draft) will be updated by reflecting of feedback from participants of training.

[Item 3-2-3] Revision of curriculum including experiment and field work of both the universities (draft)

Revision of curriculum will be made step by step at the both universities.

[Item 3-2-4] Holding of Joint Coordination Committee (JCC)

The Ministry of Mineral Resources and Energy, The Eduardo Mondlane University, Instituto Superior Politécnico de Tete and JICA will hold JCC one a year to check the progress of the project and to discuss about future activities.

[Item 3-2-5] Review of long-term training candidates

The selection of members for long-term training will be considered in continuation with Phase 1.

3) The 5<sup>th</sup>, 6<sup>th</sup>, 7<sup>th</sup>, 8<sup>th</sup> Domestic work (July-October 2017, November-December 2107, July-October 2018, November-December 2108)

[Item 3-3-1] Revision of equipment utilization training manual (draft) and equipment maintenance

management manual (draft)

Contents of both the manuals (draft) will be updated in addition to the revision made in Item 3-2-2.

[Item 3-3-2] Revision of curriculum including experiment and field work of both the universities (draft)

Revision of curriculum will be made step by step at the both universities.

[Item 3-3-3] Preparations and implementation of short-term training in Japan

The short-term training in Japan will be coordinated and conducted. The contents of the training will be determined after discussion with both the universities in Mozambique as well as Akita University.

[Item 3-3-4] Implementation of assistance for long-term trainees

Support for long-term trainees in Japan, such as participation in the short-term training, shall be considered or coordinated upon discussion with JICA and concerned people.

[Item 3-3-4] Creation and submission of Monitoring Sheet (late September 2017, 2018 and 2019)

The Monitoring Sheet as prescribed by JICA will be created jointly with the implementing body, and be submitted after thorough discussion with JICA as well as concerned body in Japan.

4) The 9<sup>th</sup> Domestic work (May-September 2019)

[Item 3-4-1] Preparations and implementation of short-term training in Japan

The short-term training in Japan will be coordinated and conducted. The contents of the training will be determined after discussion with both the universities in Mozambique as well as Akita University.

[Item 3-4-2] Implementation of assistance for long-term trainees

Support for long-term trainees in Japan, such as participation in the short-term training, shall be considered or coordinated upon discussion with JICA and concerned people

The training plan of 3<sup>rd</sup> short-term training in Japan is shown in Table 3-8.

Table 3-9 3<sup>rd</sup> Short-term Training in Japan

		Training content	Remarks
July 1	Sat.	Maputo → <i>Johannesburg</i> → <i>Hong Kong</i>	
July 2	Sun.	<i>Hong Kong</i> → <i>Tokyo</i>	JICA Tokyo
July 3	Mon.	Orientation by JICA <i>Tokyo</i> → <i>Akita</i>	Akita University
July 4	Tues.	Orientation Campus tour	Akita University
July 5	Wed.	X-ray diffraction analysis training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
July 6	Thur.	X-ray diffraction analysis training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
July 7	Fri.	X-ray diffraction analysis training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
July 8	Sat.		
July 9	Sun.		
July 10	Mon.	X-ray diffraction analysis training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
July 11	Tues.	X-ray diffraction analysis training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
July 12	Wed.	X-ray diffraction analysis training & Manual drawing-up Coal analysis training & Manual drawing-up	Akita University
July 13	Thur.	T: Akita → Sapporo Hokkaido University L: Field Trip (Tohoku district area)	Hokkaido University Tohoku district
July 14	Fri.	T: Visiting (open-cut coal mine) L: Field Trip (Tohoku district area)	Bihai Tohoku district
July 15	Sat.	T: Visiting (Museum) L: Field Trip (Tohoku district area)	Hokkaido University Tohoku district
July 16	Sun.	T: Sapporo → Kyoto L: Holiday	
July 17	Mon.		
July 18	Tues.	T: Kyoto University L: Training & Manual drawing-up	Kyoto University Akita University
July 19	Wed.	T: Visiting (Analyse equipment manufacturer) Kyoto → Kokura L: Training & Manual drawing-up	Kyoto Akita University
July 20	Thur.	T: Visiting (Limestone mine and Cement factory) Kokura → Hakata L: Training & Manual drawing-up	Higashikuni, Kanda Akita University
July 21	Fri.	T: Kyushu University L: Training & Manual drawing-up	Kyushu University Akita University
July 22	Sat.	T: Fukuoka → Tokyo	
July 23	Sun.		
July 24	Mon.	T: Visiting (Iron mill and Coal fired power plant) L: Training & Manual drawing-up	Kimitsu & Isogo Akita University
July 25	Tue.	T: Visiting (Advanced Industrial Science and Technology) L: Manual drawing-up & Reporting session	Tsukuba Akita University
July 26	Wed.	Discussion between trainees and consultant	JCOAL
July 27	Thu.	Preparation for reporting session	JCOAL
July 28	Fri.	Reporting session	JICA Head quarter
July 29	Sat.	<i>Tokyo</i> → <i>Hong Kong</i> → <i>Johannesburg</i>	
July 30	Sun.	<i>Johannesburg</i> → <i>Maputo</i>	

※T: Teacher (Professor or Lecturer)

L: Laboratory staff (Head or Technician)

[Item 3-4-3] Creation of final version of equipment utilization training manual and equipment maintenance management manual

Final version of both the manuals will be reviewed with concerning bodies including Akita University and compiled.

[Item 3-4-4] Revision of curriculum including experiment and field work of both the universities (final draft) Revision of curriculum will be made as final version at the both universities.

[Item 3-4-5] Creation of final report on the Project

The final report on the Project will be created through organizing and summarizing all the activities of Phase 1 and Phase 2.

5) The 10<sup>th</sup> On-site work (Late September 2019)

[Item 3-4-4] Report on achievement of the Project at JCC meeting

Final reporting on the Project will be made by consultant with Akita University at JCC meeting. And the equipment utilization training manual and the equipment maintenance management manual and revision of curriculum including experiment and field work will be introduced by both the universities and be reviewed by all the participants at JCC meeting.

[Item 3-4-5] Holding the seminar to report the achievement of the Project

The seminar on the Project will be held to notify the achievement of the Project. Speakers of the seminar are ranged to variety including peoples concerned with the project in Mozambique and Japan and participants in the training in the Project. At the same time, the exchange of opinions for furthermore activities after the Project, such as collaboration of joint research, intercommunication of teachers and students between universities in Japan and Mozambique, will be made at the seminar.

#### 4. Work Plan

The work plan for Phase 2 is shown in Format-2.

The Work Plan (Phase 2)

Work Item	Period	JFY2015	JFY2016	JFY2017	JFY2018	JFY2019
		1	2	3	4	5
1-1-1) Review of an activity plan for Phase 2						
1-1-2) Preparation of an activity plan for Phase 2						
1-1-3) Preparation of an activity plan for Phase 2						
1-1-4) Preparation of an activity plan for Phase 2						
1-1-5) Preparation of an activity plan for Phase 2						
1-1-6) Preparation of an activity plan for Phase 2						
1-1-7) Preparation of an activity plan for Phase 2						
1-1-8) Preparation of an activity plan for Phase 2						
1-1-9) Preparation of an activity plan for Phase 2						
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1-1-100) Preparation of an activity plan for Phase 2						

## 5. Staffing Plan

The staffing plan for Phase 2 is shown in Format-3.

Part of work	Name	2009												Report		
		1	2	3	4	5	6	7	8	9	10	11	12			
Working schedule	JCCAL	Supervisor	■													Mitsubishi Materials Techno Co., Ltd.
		Manager	■													
		Senior Engineer	■													
		Engineer	■													
		Senior Technician	■													
		Technician	■													
		Senior Technician	■													
		Technician	■													
		Senior Technician	■													
		Technician	■													
		Senior Technician	■													
		Technician	■													
Supervisor	■													JCCAL		
Manager	■															
Senior Engineer	■															
Engineer	■															
Senior Technician	■															
Technician	■															
Senior Technician	■															
Technician	■															
Senior Technician	■															
Technician	■															
Supervisor	■														Mitsubishi Materials Techno Co., Ltd.	
Manager	■															
Senior Engineer	■															
Engineer	■															
Senior Technician	■															
Technician	■															
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Technician	■															
Senior Technician	■															
Technician	■															

The Project on Capacity Development in Mineral Resources Sector in Mozambique (The second Phase) manpower planning (Draft)

## 5.1 Policy for the selection of project staff

In order to ensure the implementation of " Capacity Development in Mineral Resources Sector ", the requirement for the selection of members of research group for this operation was considered as the knowledge or capability related to overall/mine development/geological analysis, advanced technical education, coal development/coal analysis and maintenance of information in all the technical fields of equipment planning, and experience in similar surveys conducted in the past at overseas.

The experience and capability in mine development or geological analysis is required in case of "overall/mine development/geological analysis", but the policy is to have overall high business operation capability and capability related to human resource development in particular. Particularly, it is necessary to strengthen not only the technical capability but also the operational capability, since close cooperation with Akita University is required in this operation.

"Advanced technical education" aims at steady implementation of the operation through collaboration with the "coal development/coal analysis" in-charge described later by appointing engineers having extensive knowledge and experience in the field of metallic mineral resources and hydro-carbon resources. Particularly, the human resources having doctorate degree with thorough knowledge in that field or human resources having thorough knowledge about university relations were appointed through collaboration with Akita University.

The requirement for "Equipment Plan" is the accurate knowledge about equipment and operation capability. As for the equipment, the members having extensive knowledge and experience in the areas ranging from analysis related equipment to various types of analysis software were appointed.

## 6. Responsibility of Provision of Facilities from Mozambique side

### 6.1 Provision of facilities from Mozambique side

- (1) On-site short-term training  
Both Universities: Provision of classrooms, laboratories and experiment equipment  
Instituto Superior Politécnico de Tete: Securing field for field classes  
Transportation cost of participants of field classes: Borne by the participants
- (2) Holding JCC  
MIREM: Provision of meeting room  
Transportation cost of JCC participants: Borne by the participants

## II) Monitoring Sheet



**TO CR of JICA MOZAMBIQUE OFFICE**

**PROJECT MONITORING SHEET**

**Project Title : The Project on Capacity Development in Mineral Resources Sector**  
**Version of the Sheet: Ver.1 (Term: May, 2015 - Sep, 2015)**

**Name: Koichi TANAKA**  
**Title: Chief Advisor**  
**Submission Date: Sep 30, 2015**

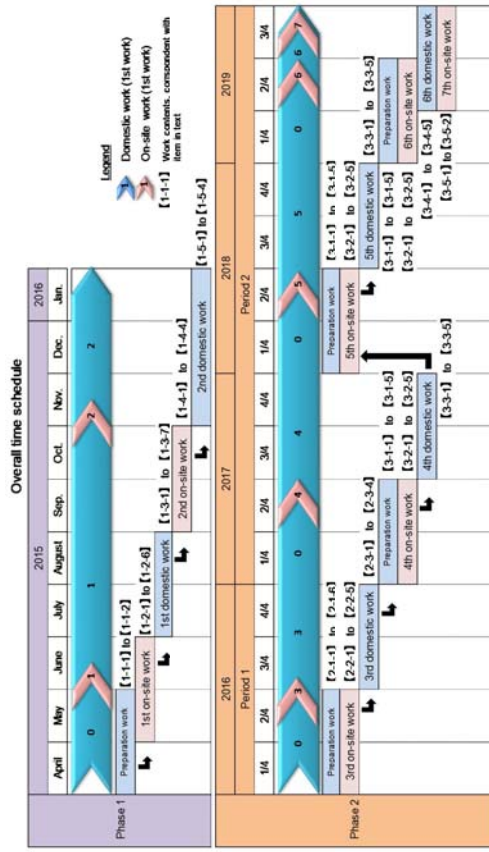
**I. Summary**

**1 Progress**

**1-1 Progress of Inputs**

An input is scheduled items based on the PDM which was created based on agreement among parties concerning this program. Short-term training program and equipment provision to be carried out future have been prepared. Five personnel as long-term trainees have been accepted into relevant universities in Japan so far. The PDM is attached as Project Monitoring Sheet 1.

Over all time schedule is shown in below table.



**1-2 Progress of Activities**

(1) Primary On-site Work. Baseline survey

- Content: The information required for conducting short-term trainings (Japan and On-site), providing equipment and conducting accompanying practical trainings at The Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete will be gathered through discussions with both the universities, relevant institutions of mineral resources and other aid arms.

- Means: To collect information from individual interviews with related agencies

- Progress: Hearing has been carried out for the relevant institutions including The Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete. However, some of the information is being added to the collection.  
 Contents and items of the baseline survey are as follows;

- i) Information about The Eduardo Mondlane University and Tete Polytechnic Institute
  - Fundamental information, organization, number of students, number of teachers and budget status.
  - Creation of list of all the teachers (academic degree status, research background), status of university's research database (storage status of research material such as thesis or references, that can be accessed by the concerned people such as students and teachers, for browsing)
  - Fundamental information, organization, number of students, number of teachers, companies in which graduated students are employed, curriculum and course information, about the target departments and relevant faculties/departments
  - Present status of centralized laboratory concept at The Eduardo Mondlane University, present status of analysis of various samples (present analysis has been outsourced to external institutions).
  - Status of various experiments and practical training at Tete Polytechnic Institute (Presently being conducted as company intern only), status (system, budget, spare parts, issues, etc.) of owned equipment and its maintenance management.
- ii) Information about support to universities by Ministry of Mineral Resources, other donors, etc
  - The status of equipment such as microscope (polarization, reflection and entity), which is an equipment related to geological survey, and field survey equipment (hammer, clinometer, etc.) provided by Ministry and other donors
  - Status of cooperation from Swedish International Development Cooperation Authority (SIDA) (Status of provision of the above-mentioned equipment related to geological survey)

- Status of support and equipment provision from private companies (including the support to Tete Polytechnic Institute from Vale Company)
- iii) Information about Revuboe Project and other projects such as Moatize coal mine
  - Need for development of human resources for Revuboe Project and at the mine development sites such as Moatize coal mine (Conduct mine inspection, survey and interviews/discussions with the operation companies at the time of this baseline survey)
  - Possibility of conducting geological inspection, field survey and research at the mine development site
- b. Discussion and Agreement on the Work Plan
  - Content: Regarding the object organizations, content and schedule in respect to this program, discussion and opinion exchange meeting will be held with the concerned people including Ministry of Mineral Resources, Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete.
  - Means: To discuss contents of program with relevant organizations on the Joint Coordination Committee (JCC)
  - Progress: 1st JCC was performed at the time of the primary on-site work, and the work plan has been agreed.
- Minutes of the 1st JCC for the Project on Capacity Development in Mineral Resources Sector is attached to Annex I.
- c. Formation of working team
  - Content: The working team for facilitating the system and environment, in which appropriate experiments or practical training can be conducted at The Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete in accordance with above baseline survey, will be set up. The priority areas for Universidade Eduardo Mondlane include natural gas, oil and metallic mineral resources, and geological inspection, geophysical exploration, and sample analysis etc. will be covered for these areas. The priority area for Instituto Superior Politecnico de Tete includes resources such as coal, and geological inspection, evaluation of ore reserves, physical properties, calorific value, moisture content, ash content, and fluidity evaluation etc. will be covered for this area.
  - Means: To consider the team member at the meeting with each university
  - Progress: Activities of the working team are already agreed with each university. However, working team members of the universities are currently under selection. The members are expected to be determined at the time of the first Japan short-term training.

- d. Review on long-term training candidates
  - Content: Consultant team requests to select long-term training candidates during interviews with each university. At the same time, the research topics are recommend for those training candidates.
  - Means: To select training candidates by each university
  - Progress: Each university is currently under consideration.
- Also, five personnel have already accepted into universities in Japan as long-term trainees.
- e. Review of participants for short-term training in Japan, Phase 1
  - Content: Consultant team requested to select long-term training candidates to the each universities. In training at the first short-term training in Japan, it is considered the contents on the future of the program content and donating equipment plan.
  - Means: To select training candidates by each university
  - Progress: Based on the consideration, three persons in each university were selected as trainees and they are going to participate in the Japanese short-term training on this October.
- (2) Primary domestic work
  - a. The agreement on support from Akita University
    - Content: With respect to the content of training in this program, selection of donation equipment and the equipment training, consultant team requests and obtains a cooperation for lectures concerning training and advices about the training to the Akita University which has signed a partnership with Universidade Eduardo Mondlane.
    - Means: To discuss the cooperation content between Akita University, JICA and consultant
    - Progress: Discussion with person in charge of international cooperation program in the Akita University was held at after the primary on-site work, which consultant team explained about the findings, challenges and requests from each university. Based on the discussion, Akita University was agreed in principle to cooperate for the training program.
  - b. Preparations of short-term training in Japan
    - Content: Preparation work for the 1st short-term training in Japan is carried out to settle on the content, schedule and invitation related to the training as a table of next page.

Schedule for 1st short-term training in Japan

	Training content	Remarks
The 1st day	Sat. Maputo → Johannesburg → Hong Kong	
The 2nd day	Sun. Hong Kong → Tokyo → Akita	
The 3rd day	Mon. Mining short-term lecture (upper stream..exploration)	Akita University
The 4th day	Tues. Mining short-term lecture (upper stream : Mine development, dressing)	Akita University
The 5th day	Wed. Mining short-term lecture (lower stream..environment)	Akita University
The 6th day	Thur. Mining short-term lecture (lower stream..mining economy)	Akita University
The 7th day	Fri. Mining short-term lecture (summary)	Akita University
The 8th day	Sat. Akita → Tokyo	
The 9th day	Sun. Holiday	
The 10th day	Mon. Briefing Program, Orientation	
The 11th day	Tues. Visiting ( JICA, Embassy of Mozambique, JCOAL, IMITEC, Japanese company expanding business in Mozambique)	
The 12th day	Wed. Tokyo → Sapporo	
The 13th day	Thur. Open cut mine	Hokkaido
The 14th day	Fri. Gas field	Hokkaido
The 15th day	Sat. Sapporo → Tokyo → Kyoto	
The 16th day	Sun. Holiday	
The 17th day	Mon. Visiting (Analysis equipment manufacturer ) Kyoto → Tokyo	Kyoto
The 18th day	Tues. Advanced Industrial Science and Technology (AIST)	around Tokyo
The 19th day	Wed. Visiting (an iron works and coal analysis facility)	around Tokyo
The 20th day	Thur. Discussion about equipment to be provided Preparation for reporting session	
The 21th day	Fri. Reporting session	
The 22th day	Sat. Tokyo → Hong Kong → Johannesburg	
The 23th day	Sun. Johannesburg → Maputo	

- Means: To coordinate content and schedule of the training with domestic relevant organizations such as Akita University, Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete.
- Progress: The coordination work was finalized and the content and schedule were determined based on this preparation work. Preparation work regarding the visiting

activities is being conducted.

Content, schedule and participant of the 1st short-term training in Japan is shown in below table and attached to Annex II.

- c. Implementation of assistance for long-term trainees
- Content: Interview with long-term trainees who are currently studying at Hokkaido University, Kyoto University and Akita University under the training program for human resources development in the mining sector is carried out. At that time, opinions on assistance related needs, training related requirements will be exchanged through communication with the same long-term trainees as well.

- Means: To share some perceptions with following five trainees
- Progress: Interview is scheduled to be continuously carried out during a training by the program for human resources at Tokyo, which needs and requests will be obtained from the trainees. Based on the interview with long-term trainees, the communication between long-term trainee and teacher in charge of university are taken well so far. Their research was commenced recently and the progress of research has begun to proceed smoothly. As the research progress, there is a possibility the new requests or requirements arise. Therefore, interviews will be continued for duration of this program. Long-term trainees at present consist of the next five students.

- i) Mr. Luis Andre Magaia, Kyoto University (from Universidade Eduardo Mondlane)
- ii) Mr. Geraldo Conde Eliseu, Hokkaido University (from Instituto Superior Politecnico de Tete)
- iii) Mr. Marove Carlos Albano, Hokkaido University (from Ministry of Mineral Resources)
- iv) Mr. Unguana Cornelio De Jesus Armindo, Hokkaido University (from Ministry of Mineral Resources)
- v) Mr. Jose Derico Levy, Akita University (from Empresa Nacional de Hidrocarbonetos)

d. Identification of equipment to be procured and planning of training (draft) relevant to utilization of the equipment

- Content: The equipment required for setting up the system and environment, where experiments and practical work such as geological inspection or sample analysis etc. can be conducted properly, will be identified based on the baseline survey, short-term training in Japan and the discussion with Akita University. In addition, training plan utilizing the equipment is prepared by the consideration.

- Means: To interview about request for the equipment from each university and consider / arrange the budget for the equipment
- Progress: Identification of donation equipment are laid out on the table about necessary

equipment with each university. The donation equipment are going to be selected by discussion with trainees and relevant persons on 1st short-term training in Japan. Considerable important point for the selection of equipment is whether or not the related person in charge of the equipment in university is able to be maintained and managed by their own capacity. Therefore, the selection of equipment is needed to take account for capacity of the technical management in university. Creation of the training plan is going to be carried out after selection of the equipment at the short-term training. At the same time, preparation equipments for thin section or microscopic observation equipments have been identified as a donation equipment at Universidade Eduardo Mondlane. On the other hand, coal analysis equipments have been identified as a donation equipment at Instituto Superior Politecnico de Tete. These equipments as a basic tool are suitable for research to carry out geological analysis and coal resources estimation. However, these equipments have not been installed in the both universities. Therefore, on-the-job training to utilize these equipments in the short-term training is important to the capacity building to create basis of the education and research for related field. Necessity of the equipments as a basic tool has been agreed by involved parties among Universidade Eduardo Mondlane, Instituto Superior Politecnico de Tete and Akita University.

e. Creation of draft training manual (draft) and equipment maintenance manual (draft) for donated equipment

- Content: To create manuals (draft) for laboratory and maintenance relevant to the donation equipment
- Means: After the identification, the manuals are created under advice of Akita University.
- Progress: The draft manual for the donated equipment are created after the selection as above item d. At the same time, advice from Akita University or research institutions shall be taken for its creation.

**1-3 Achievement of Output**

- *be currently in progress*

**1-4 Achievement of the Project Purpose**

- *be currently in progress*

**1-5 Changes of Risks and Actions for Mitigation**

- *There are no special considerations at the present moment.*

**1-6 Progress of Actions undertaken by JICA**

At the present moment, content of arrangements relevant to above items by JICA consist of coordination for travelling overseas of trainees and for importation procedure of donation equipment. Among these arrangements, the coordination for travelling of 1st short-term training in Japan was finalized in the schedule. Arrangement of travelling for the long-term trainees is going to be carried out after selection of the trainee by both university.

Arrangement relevant to donation equipment is going to be carried out after selection of the equipment by discussion on the short-term training in Japan.

**1-7 Progress of Actions undertaken by Universidade Eduardo Mondlane (UEM) and Instituto Superior Politecnico de Tete (ISPT)**

At the present moment, content under consideration by Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete are the following two items.

- To select trainees for the long-term training
  - To select donation equipment
  - To set up and select member of working team in respect to the content of training, selection of donated equipment and installation of the equipment in each university
- After these selection has been finalized, more detailed training content and related planning and manuals are scheduled to consider and create between the parties.

**1-8 Progress of Environmental and Social Considerations (if applicable)**

- *There are no special considerations at the present moment.*

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

- *There are no special considerations at the present moment.*

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

- *There are no special considerations at the present moment.*

**2 Delay of Work Schedule and/or Problems (if any)**

- *There are no special considerations at the present moment.*

**3 Modification of the Project Implementation Plan**

- *There are no special considerations at the present moment.*

**4 Preparation of Related Organizations toward after completion of the Project**

- *There are no special considerations at the present moment.*

**TO CR of JICA MOZAMBIQUE OFFICE**

**PROJECT MONITORING SHEET**

**Project Title :** The Project on Capacity Development in Mineral Resources Sector  
**Version of the Sheet:** Ver.2 (Term: OCT. 2015 - MAR. 2016)

**Name:** Koichi TANAKA

**Title:** Chief Advisor

**Submission Date:** APR, 2016

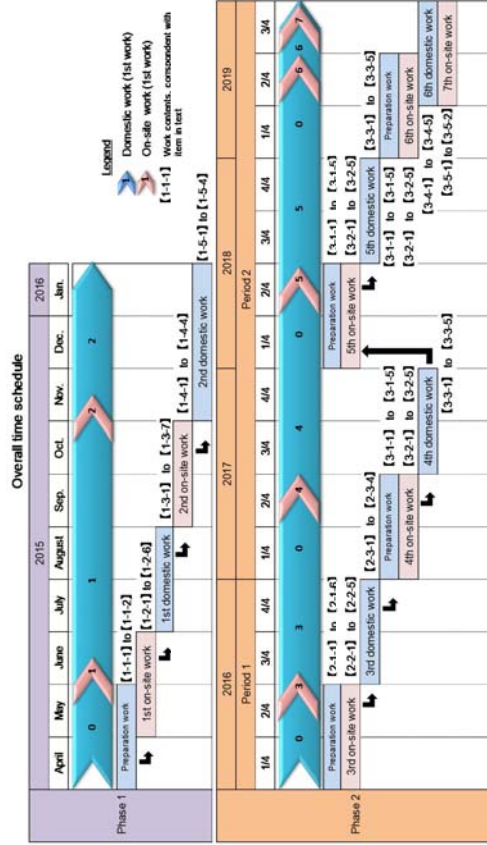
**I. Summary**

**1 Progress**

**1-1 Progress of Inputs**

An input is scheduled items based on the PDM which was created based on agreement among parties concerning this program. Short-term training program and equipment provision to be carried out future have been prepared. Five personnel as long-term trainees have been accepted into relevant universities in Japan so far. The PDM is attached as Project Monitoring Sheet 1.

Over all time schedule is shown in below table.



- Means: At the short-term training in Japan, opinions on assistance related needs and training related requirements will be exchanged through communication with the long-term trainees. If it is found after the exchanging opinions that it is necessary to take rock and/or mineral samples for the field research by long-term trainees, assistance on research by long-term trainees, such as necessary coordination with their universities to which trainees belong, it will be provided when necessary.

- Progress: 3 students of long-term trainees (1 teacher of Instituto Superior Politecnico de Tete and 2 administrative officers of Ministry of Mineral Resources), who were studying at the Hokkaido University, were joined in with the site visit at the Bibai coal mine and the Yufutsu oil-gas field at the time of the short-term training in Japan of this program on October 5 (MON) to 23 (FRI), 2015. Furthermore, interviews with the long-term trainees studying in the Hokkaido University and Kyoto University (Hokkaido University: 1 teacher of Instituto Superior Politecnico de Tete, Kyoto University: 1 teacher of Universidade Eduardo Mondlane) and the academic supervisors were conducted at the each university during the short-term training in Japan. Additionally, 1 student of long-term trainee from Ministry of Mineral Resources studying at Hokkaido University was interviewed by 1 trainee from Ministry of Mineral Resources on his visit to the Hokkaido University in the short-term training in Japan for the coal policy.

(2) Secondary on-site work

a. Conducting on-site short-term training

- Content: Professor and expert as a lecturer of Japanese side conduct short-term training in Japan and on-site including a lecture in house and field, and workshop at the Universidade Eduardo Mondlane and the Instituto Superior Politecnico de Tete.

- Means: Lecturers of training are responsible for the relevant professor of the Akita University and the technical expert in this program. When conducting the training, present resources of the Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete will be utilized. Furthermore, field excursion are also included in the training from the point of view to bring up the field geologists who are able to specialize in mineral resources for metal, oil and gas in the Universidade Eduardo Mondlane, and the engineers who are able to specialize in coal interpretation in the Instituto Superior Politecnico de Tete. Area of the field training at the secondary on-site work was intended for a coal field in Tete Province to location Instituto Superior Politecnico de Tete.

- Progress: Short-term training was held on November 30 (MON) to December 11 (FRI) at the both universities. The lecturer were as follows:

Mr. Koichi Tanaka, Japan Coal Energy Center (JCOAL)

Mr. Yoshimitsu Negishi, Mitsubishi Materials Techno Corporation (MMTEC)

Mr. Toyokazu Sugawara, Japan Coal Energy Center (JCOAL)

Prof. Ryo Imai, Akita University

Prof. Katsuyasu Sugawara, Akita University

Training schedule and program are as Annex 3.

b. Identification of equipment to be procured

- Content: Professor and technical expert of Japanese side identify necessary equipments for improvement of the research and education environment which is able to practice experiment and practical training such as a geological excursion and sample analysis in the Universidade Eduardo Mondlane and the Instituto Superior Politecnico de Tete.

- Means: The selection process took into consideration of the baseline survey conducted during the primary on-site work, and the suggestion expertized by professors of the Akita University during the 1st short-term training in Japan and the secondary on-site work.

- Progress: There are needs for equipments to manufacture of thin section and to analyze rock or minerals at the time of baseline survey in the primary on-site work in the Universidade Eduardo Mondlane. However then, SIDA donated geological fundamental equipments including the thin section creating machine for rock and mineral and the preparation system for chemical analysis in October, 2015. Therefore based on the current situation, equipments for preparation of chemical analysis and pre-interpretation of geological survey were selected as the donated items. The selected equipments are not complex. However, these equipments can be a very beneficial to bridge between fundamental and progressive research with the equipments provided by SIDA. Of these equipments, binocular stereoscopic microscope is intended to be used for the zircon separation during the U-Pb zircon dating analysis preparation process, which is an extremely important preparation measurement for determining the geological age of rocks all over Mozambique.

Selected equipments are as follows:

Selected Equipment (Universidade Eduardo Mondlane)

Name of Equipment	Purpose
i) Stereomicroscope (include light and digital camera as options)	For separation of zircon for geological dating
ii) Reflecting stereoscope	For geological and topographical interpretation of aerial photo
iii) Electronic scale	For preparation of various experiment
iv) Dryer	For drying of samples and experimental materials
v) Electric furnace	For analysis of water content, etc
vi) Laboratory materials	Chemicals for creating thin section, etc

Taking all of the above into consideration, it was decided that it would be in the best interest of Instituto Superior Politecnico de Tete to try and become the only university/research institution in the country to have the capability of conducting technical and elemental analyses. To make this possible, the Phase 1 will be to provide equipment to make industrial analyses possible, and if feasible elemental analyses in the Phase 2 to enhance the universities capacity.

The selected equipment is as follows:

Selected Equipment (Instituto Superior Politecnico de Tete)

Name of Equipment	Purpose
Diferencial thermal and thermogravimetric simultaneous measurement equipment	For analysis of moisture, ash, volatile and fixed carbon (industrial analysis)

c. Establishment of acceptance organization related to procurement of equipment

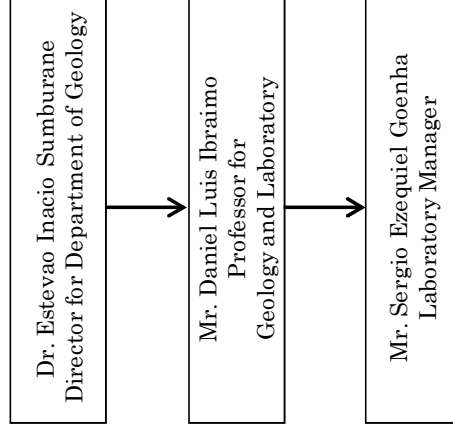
- Content: Actual deployment of equipment at the universities will be done before the third on-site survey. Then the acceptance organization at the time of acceptance of equipment in Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete is established for their smooth operation after deployment.

- Means: To establish the equipment acceptance organization in Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete, work contents after acceptance will

be discussed and confirmed in collaboration with the working team formed during the primary and secondary on-site work for setting up the organization and installation environment where appropriate experiments and practical training can be conducted.

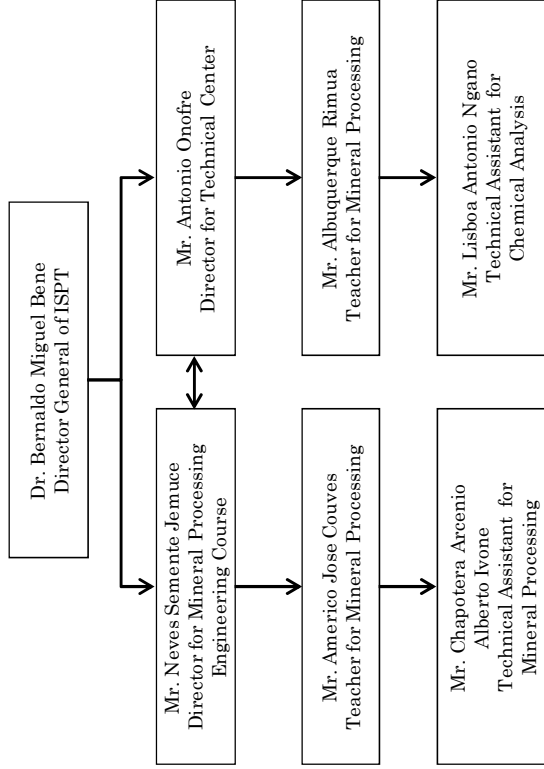
- Progress: It is necessary to free tax for import of equipments at the Mozambique Customs. For this reason, coordination between both universities and the Customs will be needed. Based on the consideration at the secondary on-site work, acceptance organization for the selected related persons is same as the working group and the structure is as follows:

Acceptance organization for the selected equipment  
(Universidade Eduardo Mondlane)





Acceptance organization for the selected equipment  
(Instituto Superior Politecnico de Tete)



d. Review of long-term training candidates

- Content: Related professor and technical expert in Japanese side ask the selection of candidates for long-term training to both universities and advise their research theme to the candidates.
- Means: Selection of the training candidates is implemented in both universities and the technical expert arranges a meeting between related professor and the candidate at the secondary on-site work.
- Progress: Professors of Akita University and technical expert in Japanese side were carried out meeting with three candidate at the Universidade Eduardo Mondlane during secondary on-site work. English-language ability of the candidates already attain to a standard undergraduate level or more of Japan. Also, willingness to their study was sufficient. Therefore, they were found to have the ability in order to proceed to the master's program. Additionally, if their long-term training were approved by JICA, the professors of Akita University as an lecturer of this short-term training in Mozambique expressed an opinion that may be acceptable them to Akita University. On the other hand, the selection of candidate for the training was still in progress at the Instituto Superior

Politecnico de Tete.

(3) Secondary domestic survey

- a. Review of equipment utilization training manual (draft) and equipment maintenance management manual (draft)
    - Content: Utilization training manual (draft) and equipment maintenance management manual (draft) for the donated equipments are created by both universities.
    - Means: Relevant teachers in both universities create these procedures and manuals supported by Akita University after selection of the equipments. At this time, it is necessary to customize to adapt the actual experimental environment of the universities about the creation of utilization procedures and maintenance manuals. For this reason, the preparation for procedures and manuals conducted by teachers and engineers is implemented with the support of Japanese professors through short-term training in Japan and on-site. This will be able to revise the procedures and manuals by themselves in the future.
    - Progress: Creation of the draft version of procedures and manuals will be commenced after procurement work for donated equipments at the Phase 2 and the creation will be proceeded while considered in cooperation with both universities after third on-site work. It is expected to get the advice from the Akita university at the time of creation.
- Procedures and manuals to schedule the creation through the training in the Phase 2 are as the following table for each university.

Possible procedure and maintenance management manual of equipment to be created by Universidade Eduardo Mondlane

1) Experimental procedure manual
• Procedure manual for preparation of rock and mineral thin section
• Procedure manual for preparation of ore polished section
• Procedure manual for polarization and reflecting microscopic observation
• Procedure manual for utilization of stereomicroscope
• Procedure manual for utilization of stereoscope
• Procedure manual for rock pulverization
• Procedure manual for mineral separation such as zircon
2) Equipment maintenance manual
• Maintenance manual for preparation equipment of rock thin section and ore polished section
• Maintenance manual for polarization and reflecting microscope
• Maintenance manual for stereomicroscope
• Maintenance manual for stereoscope
• Maintenance manual for rock pulverizer

Possible procedure and maintenance management manual of equipment to be created by Instituto Superior Politecnico de Tete

2) Equipment maintenance manual
• Maintenance manual for preparation equipment of coal analysis
• Maintenance manual for thermal scale
• Maintenance manual for rock pulverizer

b. Creation of procurement plan for the provision of equipment

- Content: The specifications of selected equipment and procurement plan regarding quantity etc. will be created in consideration of the procurement of equipment to be provided in Phase 2.

- Means: Plan for the procurement and delivery of equipment is created through the procurement and management provision of JICA.

- Progress: In the stage at the end of Phase 1, the cost estimation of the selected equipment has been acquired. Actual procurement will start after the end of the contract of the Phase 2, and equipment in excess of approximate US\$14,000 is scheduled to be procured in the bid.

c. Creation of the plan for Phase 2 (draft)

- Content: The activities of Phase 2 include procurement of equipment to be provided, conducting training on equipment utilization and maintenance management, considering and conducting country-wise training (short-term trainings in Japan and on-site short-term trainings). Regarding the contents of these activities, plan (draft) for the activities of Phase 2 will be created in the sequence of development from Phase 1, based on the progress of working team's action items that were implemented or created in Phase 1, plan for training on equipment utilization, manual (draft) for conducting equipment utilization training and equipment maintenance management manual (draft).

- Means: The plan will be created after thorough discussion with Akita University, which is participating in the research etc. and JICA.

- Progress: Activity plan regarding procurement of the equipments in Phase 2 is as follows:

Activity plan regarding procurement of the equipments in Phase 2

Content	Place	2016				2017				2018				2019				
		1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4	1/4	2/4	3/4	4/4	
UEM Procurement and Mobilization of Equipment	Japan/UEM	■																
Training for Donated Equipment				■														
Training of Research and Survey by Utilizing Equipment	Japan			■				■										
Training for Field Survey Technique				■				■										
Training for Donated Equipment				■				■										
Training of Research and Survey by Utilizing Equipment	UEM			■				■										
Training for Field Survey Technique				■				■										
Creation of Procedure and Manual for Utilizing Equipment				■				■										
ISPT																		
Procurement and Mobilization of Equipment	Japan/ISPT	■																
Training for Donated Equipment				■				■										
Training of Research and Survey by Utilizing Equipment	Japan			■				■										
Training for Coal Analysis, Geology and Development				■				■										
Training for Donated Equipment				■				■										
Training of Research and Survey by Utilizing Equipment	ISPT			■				■										
Training for Coal Analysis, Geology and Development				■				■										
Creation of Procedure and Manual for Utilizing Equipment				■				■										

- d. Creation of report on completion of Phase 1 activities
- Content: The report on completion of Phase 1 activities will be created by organizing and summarizing the contents of Phase 1.
  - Progress: The final report for the Phase 1 was submitted by the date January 12, 2016 and examination of the report was completed on January 26, 2016.

- 1-2-2 Phase 2 (Part 1)
- (1) Prior domestic work
- a. Creation of an action policy for Phase 2
- Content: An action policy for Phase 2 will be created through discussion between Akita University and JICA.
  - Means: Work plan for Phase 2 at the Phase 1 will be revised as necessary based on discussion with Akita University, JICA and related organization in Mozambique.
  - Progress: Action policy and the revised work plan were created in January, 2016. The policy was basically followed the planned content and schedule in the Phase 1.
- b. Consideration and planning of country-by-country training
- Content: Content of the country-by country training in the period of February -December, 2016 of the Phase 2 will be considered and designed based on the actual training already conducted in the Phase 1.
  - Means: Training in this period will be basically followed the actual content in the Phase 1. However, selection of equipments is scheduled to have been completed at this point. For this reason, the training include how to use the equipment that will be procured. Consideration and planning for this training are carried out at the same moment of creation of the action policy for the Phase 2. At this time, the plan was sufficient consultation with Akita University.
  - Progress: Training content in the Phase 2 has been concerning and planning along with the creation of the work completion report that was created in January 12, 2016. The content is shown in the training plan in relation to utilization of equipment as Annex 4.
- 1-3 Achievement of Output**
- be currently in progress
- 1-4 Achievement of the Project Purpose**
- be currently in progress
- 1-5 Changes of Risks and Actions for Mitigation**
- There are no special considerations at the present moment.
- 1-6 Progress of Actions undertaken by JICA**
- Contents to be adjusted by JICA side hereafter consist of travel coordination of the participants for the secondary short-term training in Japan, travel and other coordination related to long-term trainee, and coordination of mobilization for the donated equipment.

Of these coordination, travel coordination will be implemented after discussion with both universities in the third on-site work.  
Regarding coordination of travel for the long-term training, it is also included coordination with Kizuna Program for human resources development of mineral resources and the coordination is being carried out as needed. Furthermore, it is necessary for JICA to prepare an application letter to the each universities for a free tax regarding the import of donated equipment at the Mozambique Customs. The letter will be created after determination of the donated equipment.

**1-7 Progress of Actions undertaken by Universidade Eduardo Mondlane (UEM) and Instituto Superior Politecnico de Tete (ISPT)**

Content under consideration at the Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete at the moment is the next three items.  
- Selection of candidates for a long-term training  
- Preparation for mobilization of donated equipments  
- Preparation for creation of utilization and maintenance management manual for equipments

**1-8 Progress of Environmental and Social Considerations (if applicable)**

• *There are no special considerations at the present moment.*

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

• *There are no special considerations at the present moment.*

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

• *There are no special considerations at the present moment.*

**2 Delay of Work Schedule and/or Problems (if any)**

The commencement of the Phase 2 at the time of planning was February, however the convenience of the contract, the Phase 2 and the procurement of equipments are scheduled to begin from April, 2016. Furthermore, transportation of the equipments to Mozambique is expected to be after this July.

**3 Modification of the Project Implementation Plan**

• *There are no special considerations at the present moment.*

**4 Preparation of Related Organizations toward after completion of the Project**

• *There are no special considerations at the present moment.*

**TO CR of JICA MOZAMBIQUE OFFICE**

**PROJECT MONITORING SHEET**

**Project Title : The Project on Capacity Development in Mineral Resources Sector**  
**Version of the Sheet: Ver.3 (Term: APR, 2016 - SEP, 2016)**

**Name: Koichi TANAKA**  
**Title: Chief Advisor**  
**Submission Date: OCT, 2016**

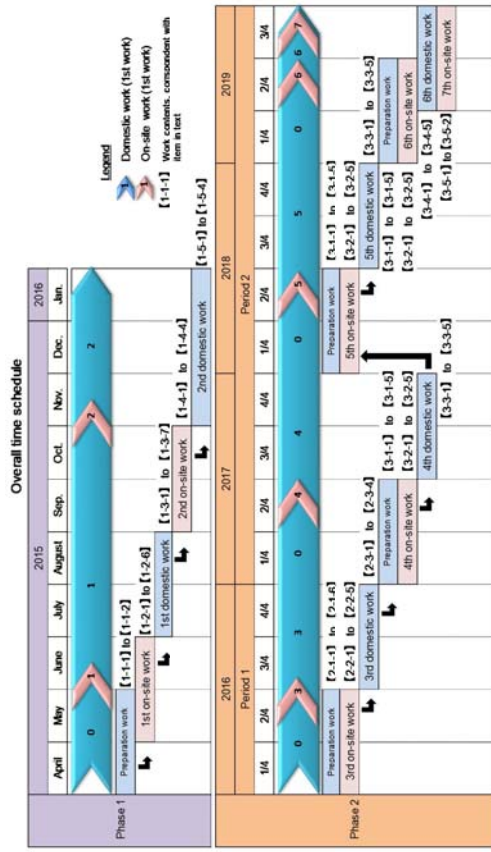
**I. Summary**

**1 Progress**

**1-1 Progress of Inputs**

An input is scheduled items based on the PDM which was created based on agreement among parties concerning this program. Short-term training program and equipment provision to be carried out future have been prepared. Five personnel as long-term trainees have been accepted into relevant universities in Japan so far. The PDM is attached as Project Monitoring Sheet 1.

Over all time schedule is shown in below table.



**1-2 Progress of Activities**

- 1-2-1 Phase 2
- (1) Preliminary domestic work (April-August, 2016)
  - a. Creation and submission of Monitoring Sheet (April 2016)
  - Content: Consultant team organizes the activities during October 2015-March 2016 and reports the progress situation of this project.
  - Means: Consultant team prepare Monitoring Sheet according to the designated form of JICA.
  - Progress: Monitoring Sheet for October 2015-March 2016 was created as Annex 1.
  - b. Procurement of laboratory equipment provided by JICA
  - Content: About the selected equipment in Phase 1, the procurement of equipment will be made based on the specifications and quantity created in Phase 1.
  - Means: Consultant team procures selected equipment based on the procurement provision of JICA. In addition consultant team dispatches the procurement equipment to the Universidade Eduardo Mondlane and the Instituto Superior Politecnico de Tete, and fix up the equipment at the both universities.
  - Progress: Consultant team procured the selected equipment as following tables (Table 1, Table 2) and made arrangement for the delivery of the equipment. Selection of the equipment was carried out from Phase 1 and the actual procurement procedure was commenced on April 2016 after the contract of Phase 2 between JICA and consultant. Selection of the dealer and order were performed in May based on the procurement procedure and the procedure of equipment preparation and export was completed in July. The shipment was finally carried out at the beginning of August.

(2) The 3rd On-site Work (August-September 2016)

- a. Check of the condition of laboratory equipment provided by JICA will be checked for properly set and operational.
- Content: he condition of laboratory equipment provided by JICA will be checked for properly set and operational.
- Means: Checking work will be done jointly with working teams of UEM and ISPT. If any flaw is detected, the necessary correcting measures shall be issued.
- Progress: Consultant team checked the arrival of equipment shown as Table 2 at the Instituto Superior Politecnico de Tete during the 3rd On-site Work. However, setup of the equipment was not completed the installation at that time, which an opening of the package, an assembly of the equipment, and a check of the operation by a technician of the manufacturer (SHIMADZU) were needed. The dispatch of a technician to the Instituto Superior Politecnico de Tete did not accomplish within this work period. These work was

Table 1 Procurement equipment for the Universidade Eduardo Mondlane

No.	Description	Quantity
1	Stereo microscope	1
	SMZ1270 (SMZ1270TERG-DSL32-POL)	1
	SMZ1270 (SMZ1270TERG-PS32)	1
2	Accessories for the stereo microscope	1
	Episcopic illuminator, Polarizing Set and Digital Camera Adapter Set	1
3	Micro, stereoscope	1
	SOKKIA MS27	1
	SOKKIA MS16	14
4	Laboratory constant temperature ovens	2
	YAMATO DVS602	2
5	Electronic merfule furnace	2
	SHIMADZU MPN-310P	2
6	Electronic analytical scale	3
	SHIMADZU AUW220	3
	SHIMADZU UW420H	3
7	Chemistry apparatus	3
	Lakeside Cement NICHKA LC-12	2
	Canada Balsam	10
	Accessories for Probe box TC-1	20
	Stainless steel trays	4
	Scoops (square type)	4
	Spoon	10
	Spatulas	10
	Tweezers	5
	Wash bottles	10

Table 2 Procurement equipment for the Instituto Superior Politecnico de Tete

No.	Description	Quantity
	Simultaneous Thermogravimetry/Differential Thermal Analyzers (DTG-60)	1
i	Main unit of the DTG-60	1
ii	Control hardware (TA-60WS)	1
iii	Atmosphere control part (FC-60A)	1
iv	Decompression part (for N2)	1
v	Conduit tube for carrier gas (5m)	1
vi	Sample cell for Pt	10

carried out at the 4th On-site Work.

On the other hand, the arrival of equipment for the Universidade Eduardo Mondlane to the Port of Maputo was delayed on account of the reasons to reveal that a incendiary materials was included in the selected equipment. Therefore, the dispatch was performed before the 4th On-site Work.

b. Conducting on-site short-term training

- Content: Professor and expert as a lecturer of Japanese side conduct short-term training in Japan and on-site including a lecture in house and field, and workshop at the Universidade Eduardo Mondlane and the Instituto Superior Politecnico de Tete. Although

the content of training is to follow up the actual activities at the Phase 1 essentially, the trainings about use of equipment and maintenance management concerning the donated equipment at the Phase 2 are performed.

- Means: Lecturers of training are responsible for the relevant professor of the Akita University and the technical expert in this program. When conducting the training, present resources of the Universidade Eduardo Mondlane and the Instituto Superior Politecnico de Tete will be utilized. Furthermore, field excursion are also included in the training from the point of view to bring up the field geologists who are able to specialize in mineral resources for metal, oil and gas in the Universidade Eduardo Mondlane, and the engineers who are able to specialize in coal interpretation in the Instituto Superior Politecnico de Tete. Area of the field training at the secondary on-site work was intended for a coal field in Tete Province to location of the Instituto Superior Politecnico de Tete.

- Progress: Short-term training was held on August 29 (MON) to September 9 (FRI) at the both universities. The lecturer were as follows:

Mr. Koichi Tanaka, Japan Coal Energy Center (JCOAL)

Mr. Yoshimitsu Negishi, Mitsubishi Materials Techno Corporation (MMTEC)

Prof. Ryo Imai, Akita University

Prof. Katsuyasu Sugawara, Akita University

Assist.Prof. Takahiro Kato, Akita University

Training schedule and program are as Annex 2.

c. Holding of the Joint Coordination Committee (JCC) meeting

- Content: JCC meeting will be held to review the progress of the project.

- Means: The revised work plan will be discussed and the opinions on future policy will be exchanged in the committee meeting. And the present condition of the working group in the universities about connection with arrangement of the equipment will be also discussed by JCC.

- Progress: JCC was performed at the time of the 3rd On-site Work, and the work plan has been agreed. Minutes of this JCC is attached to Annex 3.

d. Review of long-term training candidates

- Content: The selection of members for long-term training will be considered in continuation with Phase 1.

- Means: Selection of the long-term training candidates will be created based on the result of interviews and discussions.

- Progress: At the time of the 3rd On-site Work, the the Universidade Eduardo Mondlane and the Instituto Superior Politecnico de Tete were selecting the candidates.

(3) The 3rd Domestic Work (September-October 2016)

- a. Implementation of short-term training in Japan
  - Content: The short-term training in Japan will be coordinated and conducted. The participants of the training are targeted for the lectures and laboratory staff involved in practical operations of research or laboratory equipment, and the lectures involved in curriculum improvement work at both universities.
  - Means: The training will be conducted mainly at Akita University, which has entered into an academic exchange agreement with the Eduardo Mondlane University. Training also will be held at other universities and mine site at etc.
  - Progress: Four persons involved in the both universities were invited to the training in Japan during from September 26 (MON) to October 21 (FRI), 2016. List of participants, schedule and program of the training are shown on Annex 4.
- b. Creation of equipment utilization training manual and equipment maintenance management manual
  - Content: Manuals for training and maintenance relation to the donated equipment, which prepared at the 3rd On-site Work, are commenced to create by actual trainees at this short-term training in Japan.
  - Means: The training is performed in Akita University and the contents consist of training for an industrial analysis by using differential thermal analysis and preparation for a thin section and polish to observe rock and minerals. These manuals are created by the trainee with performing operation of the actual analytical instrument and equipment.
  - Progress: Trainees are carrying out preparing manuals with operations of the instrument and equipment at the end of September.
- c. Implementation of assistance for long-term trainees
  - Content: Five members (1 teacher from Instituto Superior Politecnico de Tete, 1 teacher from the Universidade Eduardo Mondlane, 2 administrative officers from the Ministry of Mineral Resources, and 1 engineer from Empresa Nacional de Hidrocarbonetos) from Mozambique are presently in Japan for the long-term training under the training program for human resources development in the mining sector called Kizuna Program. Furthermore, one person from the Universidade Eduardo Mondlane is newly visiting Japan, who examined after commencement of this project.
  - Means: At the short-term training in Japan, opinions on assistance related needs and training related requirements will be exchanged through communication with the long-term trainees. If it is found after the exchanging opinions that it is necessary to take

rock and/or mineral samples for the field research by long-term trainees, assistance on research by long-term trainees, such as necessary coordination with their universities to which trainees belong, it will be provided when necessary.

Progress: 3 students of long-term trainees (1 teacher of Instituto Superior Politecnico de Tete and 2 administrative officers of Ministry of Mineral Resources), who were studying at the Hokkaido University, were joined in with the site visit at the Bibai open-pit coal mine at Bibai City and the environmental reclamation site for abandoned coal washing waste dump at Yubari City at the time of the short-term training in Japan for the coal policy on May 23 (MON) to Jun 17 (FRI), 2016.

Furthermore, interviews with 2 long-term trainees studying in the Akita University (1 engineer from Empresa Nacional de Hidrocarbonetos and 1 teacher of Universidade Eduardo Mondlane) were conducted during this short-term training in Japan. Additionally, an interview with 1 long-term trainee, who was newly enrolled at the Hokkaido University (1 associated engineer of MIREME), is due to be performed at the Hokkaido University. In addition, 1 trainee studying in the Waseda University (1 engineer from Ministry of Mineral Resources) is going to be joined in with the site visit at the steel plant of the Nippon Steel and Sumitomo Metal at the time of the short-term training in Japan on September 26 (MON) to October 21 (FRI), 2016.

**1-3 Achievement of Output**

- be currently in progress

**1-4 Achievement of the Project Purpose**

- be currently in progress

**1-5 Changes of Risks and Actions for Mitigation**

- There are no special considerations at the present moment.

**1-6 Progress of Actions undertaken by JICA**

Contents to be adjusted by JICA side hereafter consist of a coordination for dispatch professors of Akita University to Mozambique at the 4<sup>th</sup> On-site training, travel coordination of the participants for the 3rd short-term training in Japan, and travel and other coordination related to long-term trainee.

Of these coordination, travel coordination will be implemented after discussion with both universities in the 5th On-site Work. Regarding coordination of travel for the long-term training, it is also included coordination with Kizuna Program for human resources development of mineral resources and the coordination is being carried out as needed.

**1-7 Progress of Actions undertaken by Universidade Eduardo Mondlane (UEM) and Instituto Superior Politecnico de Tete (ISPT)**

Content under consideration at the Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete at the moment is the next three items.

- Selection of candidates for a long-term training
- Preparation for creation of utilization and maintenance management manual for equipments
- Preparation for receiving of donated equipments (Universidade Eduardo Mondlane)

**1-8 Progress of Environmental and Social Considerations (if applicable)**

- *There are no special considerations at the present moment.*

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

- *There are no special considerations at the present moment.*

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

- *There are no special considerations at the present moment.*

**2 Delay of Work Schedule and/or Problems (if any)**

The commencement of the Phase 2 at the time of planning was February, however the convenience of the contract, the Phase 2 and the procurement of equipments are scheduled to begin from April, 2016. Furthermore, transportation of the equipments to Mozambique is expected to be after this July.

**3 Modification of the Project Implementation Plan**

- *There are no special considerations at the present moment.*

**4 Preparation of Related Organizations toward after completion of the Project**

- *There are no special considerations at the present moment.*



**TO CR of JICA MOZAMBIQUE OFFICE**

**PROJECT MONITORING SHEET**

**Project Title : The Project on Capacity Development in Mineral Resources Sector**  
**Version of the Sheet: Ver.4 (Term: OCT. 2016 - MAR. 2017)**

**Name: Koichi TANAKA**

**Title: Chief Advisor**

**Submission Date: MAR. 2017**

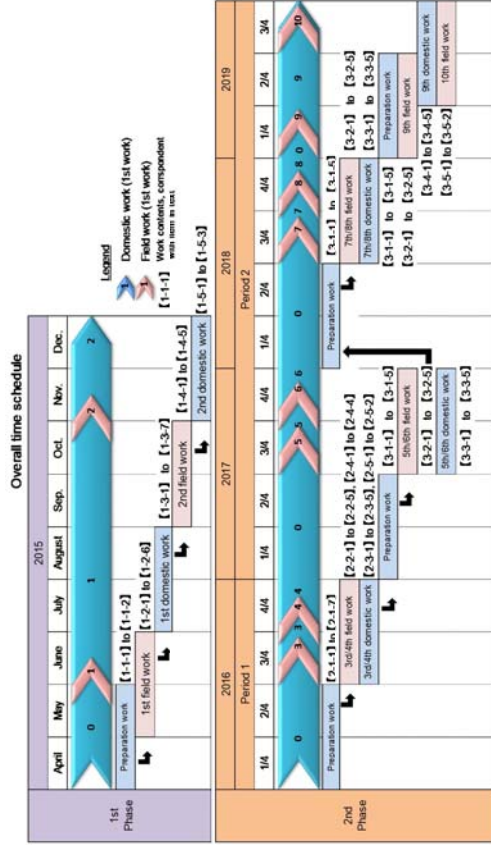
**I. Summary**

**1 Progress**

**1-1 Progress of Inputs**

An input is scheduled items based on the PDM which was created based on agreement among parties concerning this program. Short-term training program and equipment provision to be carried out future have been prepared. Five personnel as long-term trainees have been accepted into relevant universities in Japan so far. The PDM is attached as Project Monitoring Sheet 1.

Over all time schedule is shown in below table.



**1-2 Progress of Activities**

**1-2-1 Phase 2**

(1) The 3rd Domestic Work (September-October 2016)

- a. Implementation of short-term training in Japan
  - Content: The short-term training in Japan was coordinated and conducted. The participants of the training are targeted for the lectures and laboratory staff involved in practical operations of research or laboratory equipment, and the lectures involved in curriculum improvement work at both universities.
  - Means: The training will be conducted mainly at Akita University, which has entered into an academic exchange agreement with the Eduardo Mondlane University. Training also will be held at other universities and mine site at etc.
  - Progress: Four persons involved in the both universities were invited to the training in Japan during from September 26 (MON) to October 21 (FRI), 2016. List of participants, schedule and program of the training are shown on Annex 1.
- b. Creation of equipment utilization training manual and equipment maintenance management manual
  - Content: Manuals for training and maintenance relation to the donated equipment, which prepared at the 3rd On-site Work, were commenced to create by actual trainees at this short-term training in Japan.
  - Means: The training is performed in Akita University and the contents consists of training for an industrial analysis by using differential thermal analyzer and preparation for a thin section and polish to observe rock and minerals. These manuals are created by the trainees with performing operation of the actual analytical instrument and equipment.
  - Progress: Trainees were carried out preparing manuals with operations of the instrument and equipment at the end of September. These manuals are shown in Annex 2.
- c. Implementation of assistance for long-term trainees
  - Content: Five members (1 teacher from Instituto Superior Politecnico de Tete, 1 teacher from the Universidade Eduardo Mondlane, 2 administrative officers from the Ministry of Mineral Resources, and 1 engineer from Empresa Nacional de Hidrocarbonetos) from Mozambique are presently in Japan for the long-term training under the training program for human resources development in the mining sector called Kizuna Program. Furthermore, one person from the Universidade Eduardo Mondlane has come to Japan, who examined after commencement of this project.
  - Means: At the short-term training in Japan, opinions on assistance related needs and training related requirements will be exchanged through communication with

the long-term trainees. If it is found after the exchanging opinions that it is necessary to take rock and/or mineral samples for the field research by long-term trainees, assistance on research by long-term trainees, such as necessary coordination with their universities to which trainees belong, it will be provided when necessary.

- Progress: 3 students of long-term trainees (1 teacher of Instituto Superior Politecnico de Tete and 2 administrative officers of Ministry of Mineral Resources), who were studying at the Hokkaido University, were joined in with the site visited at the Bibai open-pit coal mine at Bibai City and the environmental reclamation site for abandoned coal washing waste dump at Yubari City at the time of the short-term training in Japan for the coal policy on May 23 (MON) to Jun 17 (FRI), 2016.

Furthermore, interviews with 2 long-term trainees studying in the Akita University (1 engineer from Empresa Nacional de Hidrocarbonetos and 1 teacher of Universidade Eduardo Mondlane) were conducted during this short-term training in Japan. Additionally, an interview with 1 long-term trainee, who was newly enrolled at the Hokkaido University (1 associated engineer of MIREME), is due to be performed at the Hokkaido University. In addition, 1 trainee studying in the Waseda University (1 engineer from Ministry of Mineral Resources) was joined in with the site visit at the steel plant of the Nippon Steel and Sumitomo Metal at the time of the short-term training in Japan on September 26 (MON) to October 21 (FRI), 2016.

(2) The 4th On-site Work (October - November 2016)

a. Confirmation of installation of laboratory equipment provided by JICA

- Content: The condition of laboratory equipment provided by JICA will be checked for properly set and operational.

- Means: Checking work will be done jointly with working teams of UEM and ISPT.

- Progress: Consultant team checked that the donated equipment in the ISPT as shown in Table 1 has been completed an installation during the 4<sup>th</sup> On-site Work. After opening of the package and installation work in the laboratory, checking work of the operation and training for the differential thermal analysis to laboratory stuffs using rock samples which were prepared by trainees were conducted.

On the other hand, the equipment provided by JICA for the UEM as shown in Table 2 was in the processing of customs procedures at the Maputo port customs during the 4<sup>th</sup> On-site Work.

Management systems of equipment was also revised in compliance with the current status of each universities. Revised management systems of equipment are shown in Figure 1 and Figure 2.

Table 1. Procurement equipment for the Instituto Superior Politecnico de Tete.

No.	Description	Quantity
	Simultaneous Thermogravimetry/Differential Thermal Analyzers (DTG-60)	
i)	Main unit of the DTG-60	1
ii)	Control hardware (TA-60WS)	1
iii)	Atmosphere control part (FC-60A)	1
iv)	Decompression part (for N <sub>2</sub> )	1
v)	Conduit tube for carrier gas (6m)	1
vi)	Sample cell for Pt	10

Table 2. Procurement equipment for the Universidade Eduardo Mondlane.

No.	Description	Quantity
1	Stereo microscope	
	SMZ1270 (SMZ1270TERG-DSL32-POL)	1
	SMZ1270 (SMZ1270TERG-PS32)	1
2	Accessories for the stereo microscope	
	Episcopic Illuminator, Polarizing Set and Digital Camera Adapter Set	1
3	Mirror stereoscope	
	SOKKIA MS27	1
	SOKKIA MS16	14
4	Laboratory constant temperature ovens	
	YAMATO DVS602	2
5	Electronic muffle furnace	
	SHIMADZU MPN-310P	2
6	Electronic analytical scale	
	SHIMADZU AUW220	3
	SHIMADZU UM420H	3
	SHIMADZU UW1020H	3
7	Chemistry apparatus	
	Lakeside Cement NICHKA LC-12	2
	Canada Balsam	10
	Accessories for Probe box TC-1	2
	Stainless steel trays	20
	Scoops (square type)	4
	Scoops (small)	4
	Spoon	10
	Spatulas	10
	Tweezers	5
	Wash bottles	10

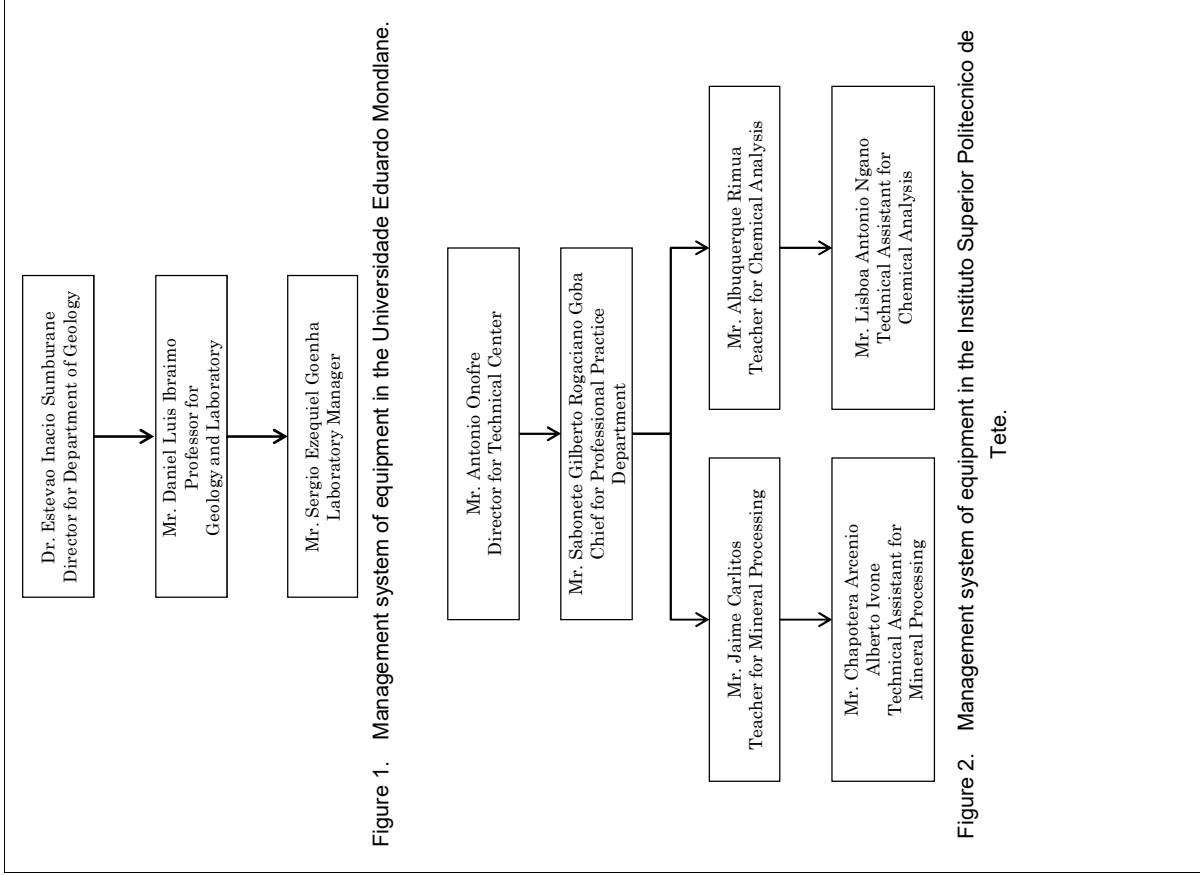


Figure 1. Management system of equipment in the Universidade Eduardo Mondlane.

Figure 2. Management system of equipment in the Instituto Superior Politecnico de Tete.

- b. Conducting of short-term training in Mozambique
    - Content: The 3rd short-term training in Mozambique will be conducted in similar way as the previous ones. However, the content of the training will be focused on equipment utilization training and equipment maintenance management using laboratory equipment procured.
    - Means: Lecturers of training are responsible for the relevant professor of the Akita University and the technical expert in this program. When conducting the training, present resources of the Universidade Eduardo Mondlane and the Instituto Superior Politecnico de Tete will be utilized. Furthermore, field excursion are also included in the training from the point of view to bring up the field geologists who are able to specialize in mineral resources for metal, oil and gas in the Universidade Eduardo Mondlane, and the engineers who are able to specialize in coal interpretation in the Instituto Superior Politecnico de Tete. Area of the field training at the secondary on-site work was intended for a coal field in Tete Province to location of the Instituto Superior Politecnico de Tete.
    - Progress: Short-term training was held on November 1 (TUE) to November 12 (SAT) at the both universities. The lecturer were as follows:
      - Mr. Koichi Tanaka, Japan Coal Energy Center (JCOAL)
      - Mr. Yoshimitsu Negishi, Mitsubishi Materials Techno Corporation (MMTEC)
      - Mr. Shusaku MIYAIKE, Mitsubishi Materials Techno Corporation (MMTEC)
      - Assist.Prof. Ryohei Takahashi, Akita University
      - Prof. Katsuyasu Sugawara, Akita University
      - Assist.Prof. Takahiro Kato, Akita University
 Training schedule and program are as Annex 3.
  - c. Creation of equipment utilization training manual (draft) and equipment maintenance management manual (draft)
    - Content: Contents of both the manuals (draft) will be updated by reflecting of feedback from participants of training.
    - Means: Both the manuals (draft) which created by participants of short-term training in Japan which was held on September to November in 2016 will be updated and revised after using provided equipment by JICA in the both universities.
    - Progress: Training using provided differential thermal analyzer provided by JICA in ISPT was conducted. But updating and revise of the manual has not been completed, because it would take much time to check the operation of equipment during the short-term training in Mozambique.
- The manual for creation of the thin sample which was created by participant from UEM

<p>also has not been updated and revised, because equipment for thin sample preparation which has provided by SIDA had not completed an installation in the laboratory in UEM.</p> <p>d. Review of long-term training candidates</p> <ul style="list-style-type: none"> <li>- Content: The selection of members for long-term training will be considered in continuation with Phase 1.</li> <li>- Means: Selection of the long-term training candidates will be created based on the result of interviews and discussions.</li> <li>- Progress: An interview with 7 candidates for long-term training that will be commenced in 2017 was conducted at UEM with Prof. Katsuyasu Sugawara and Assist.Prof. Ryohei Takahashi, Akita University. To hold hearing regarding study theme in UEM and that will be conducted in Japan, validity of the laboratory and these main target of research in the university in Japan for each candidates was discussed and confirmed.</li> </ul> <p>Whereas in ISPT, it was under consideration about candidates selection for long-term training.</p> <p>(3) The 4th domestic work (November 2016 to January 2017)</p> <p>a. Creation of equipment utilization training manual (draft) and equipment maintenance management manual (draft)</p> <ul style="list-style-type: none"> <li>- Content: Both the manuals (draft), which have been created by laboratory technical staff and lecturers in charge on their own initiative at each university by the 4<sup>th</sup> On-site work, will be compiled as the manuals (draft) at the time of phase 2 - part 1.</li> <li>- Means: Correction and revision will be done by checking contents of manuals (draft) which have been created by the 4<sup>th</sup> On-site work. In such cases, professors of the Japanese side in Akita University point out details about technical contents of the correction and revision to the person in charge of the equipment in each universities through consultant.</li> <li>- Progress: Contents which required to correct and revise were pointed out at every time by the 4<sup>th</sup> domestic work. It will be continued until the technical training that will be conducted going forward, then manuals will be updated.</li> </ul> <p>b. Discussion and creation of course of work of phase 2 - part 2</p> <ul style="list-style-type: none"> <li>- Content: The activities for Phase 2 – part 2 will be planned by expanding those of Phase 1 and Phase 2 – part 2.</li> <li>- Content: Discussion and creation of course of work will be conducted based on the progress of action plan created by the working team on the Phase 1, and the program of short-term training for the equipment utilization, the draft manuals for the equipment</li> </ul>
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<p>utilization and the draft manual for the equipment maintenance management. On this occasion, the program will be created after thorough discussion with Akita University and JICA.</p> <ul style="list-style-type: none"> <li>- Progress: It is still under planning at the present moment. It will be discussed about the program with professors at Akita University on meeting which will be held on April, 2017.</li> </ul> <p><b>1-3 Achievement of Output</b></p> <ul style="list-style-type: none"> <li>• <i>be currently in progress</i></li> </ul> <p><b>1-4 Achievement of the Project Purpose</b></p> <ul style="list-style-type: none"> <li>• <i>be currently in progress</i></li> </ul> <p><b>1-5 Changes of Risks and Actions for Mitigation</b></p> <ul style="list-style-type: none"> <li>• <i>There are no special considerations at the present moment.</i></li> </ul> <p><b>1-6 Progress of Actions undertaken by JICA</b></p> <p>Contents to be adjusted by JICA side hereafter consist of a coordination for dispatch professors of Akita University to Mozambique at the 4<sup>th</sup> On-site training, travel coordination of the participants for the 3rd short-term training in Japan, and travel and other coordination related to long-term trainee.</p> <p>Of these coordination, travel coordination will be implemented after discussion with both universities in the 5th On-site Work. Regarding coordination of travel for the long-term training, it is also included coordination with Kizuna Program for human resources development of mineral resources and the coordination is being carried out as needed.</p> <p><b>1-7 Progress of Actions undertaken by Universidade Eduardo Mondlane (UEM) and Instituto Superior Politecnico de Tete (ISPT)</b></p> <p>Content under consideration at the Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete at the moment is the next three items.</p> <ul style="list-style-type: none"> <li>- Selection of candidates for a long-term training</li> <li>- Preparation for creation of utilization and maintenance management manual for equipments</li> <li>- Preparation for receiving of donated equipments (Universidade Eduardo Mondlane)</li> </ul> <p><b>1-8 Progress of Environmental and Social Considerations (if applicable)</b></p> <ul style="list-style-type: none"> <li>• <i>There are no special considerations at the present moment.</i></li> </ul>
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**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

- *There are no special considerations at the present moment.*

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

- *There are no special considerations at the present moment.*

**2 Delay of Work Schedule and/or Problems (if any)**

The commencement of the Phase 2 at the time of planning was February, however the convenience of the contract, the Phase 2 and the procurement of equipments are scheduled to begin from April, 2016. Furthermore, transportation of the equipments to Mozambique is expected to be after this July.

**3 Modification of the Project Implementation Plan**

- *There are no special considerations at the present moment.*

**4 Preparation of Related Organizations toward after completion of the Project**

- *There are no special considerations at the present moment.*

**TO CR of JICA MOZAMBIQUE OFFICE**

**PROJECT MONITORING SHEET**

**Project Title: The Project on Capacity Development in Mineral Resources Sector**  
**Version of the Sheet: Ver.5 (Term: APR, 2017 - SEP, 2017)**

**Name: Koichi TANAKA**

**Title: Chief Advisor**

**Submission Date: SEP, 2017**

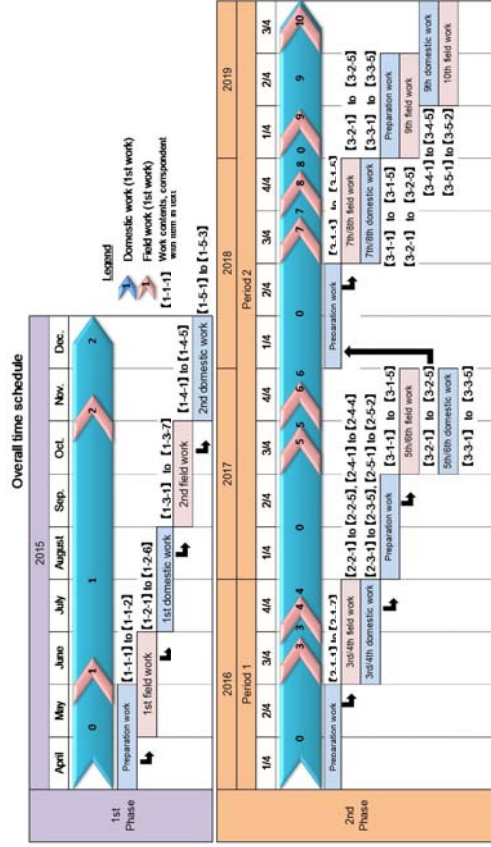
**I. Summary**

**1 Progress**

**1-1 Progress of Inputs**

An input is scheduled items based on the PDM which was created based on agreement among parties concerning this program. Short-term training program and equipment provision have been carried out now. Eleven peoples as long-term trainees have been accepted into relevant universities in Japan so far. The PDM is attached as Project Monitoring Sheet 1.

Over all time schedule is shown in below table.



**1-2 Progress of Activities**

- 1-2-1 Phase 2 - part 2
  - (1) Prior domestic work
- a. Creation of an action policy for Phase 2 – part 2
  - Content: An action policy for Phase 2 – part 2 will be created through discussion with Akita University and JICA.
  - Means: Work plan for Phase 2 – part 2 will be revised as necessary based on discussion with Akita University, JICA and related organization in Mozambique.
  - Progress: Action policy and the revised work plan were created in January, 2017. The policy has basically followed the planned content and schedule in the Phase 1.
- b. Creation and submission of Monitoring Sheet (April 2017)
  - Content: Consultant team summarizes the activities during October 2016–March 2017 and reports the progress situation of this project.
  - Means: Consultant team prepare Monitoring Sheet according to the designated form of JICA.
  - Progress: Monitoring Sheet for October 2016–March 2017 was created as Annex 1.
- c. Consideration and planning of country-by-country training
  - Content: Content of the country-by country training in the period of February -December, 2017 of the Phase 2 – part 2 will be considered and designed based on the actual training already conducted in the Phase 1 and Phase 2 – part 1.
  - Means: Training in this period will basically follow the actual content in the Phase 1 and Phase 2 – part 1. However, donation of equipment have been completed at this point. For this reason, the training includes how to use the provided equipment. Consideration and planning for this training are carried out at the same moment of creation of the action policy for the Phase 2- part 2. The plan was made after sufficient consultation with Akita University in a similar way as Phase 1 and Phase 2 – part 1.
  - Progress: Training content in the Phase 2 has been viewed and planned along with the creation of the work completion report of Phase 1 that was created in January 12, 2016. The content is shown in the training plan in relation to utilization of equipment as Annex 2.
- (2) The 5th On-site Work (May2017)
  - a. Confirmation of installation of laboratory equipment provided by JICA
    - Content: The condition of laboratory equipment provided by JICA will be checked to make sure that equipment is properly set and operational.

- Means: Checking work will be done jointly with working teams of UEM and ISPT.  
- Progress: Consultant team checked that the donated equipment in the UEM as shown in Table 1 has been completed an installation during the 5<sup>th</sup> On-site Work. After opening of the package and installation work in the laboratory and checking work of the operation and instruction for these equipment to laboratory stuffs were conducted.

Table 1. Procurement equipment for the Universidade Eduardo Mondlane.

No.	Description	Quantity
1	Stereo microscope SMZ1270 (SMZ1270TERG-DL32-POL)	1
1	SMZ1270 (SMZ1270TERG-PS32)	1
2	Accessories for the stereo microscope Episcopic illuminator, Polarizing Set and Digital Camera Adapter Set	1
3	Micro. stereoscope SOKKIA MSZ7	1
1	SOKKIA MS16	14
4	Laboratory constant temperature ovens YAMATO DVS602	2
5	Electronic mercuric lumace SHIMADZU MPN-310P	2
6	Electronic analytical scale SHIMADZU AUW220	3
3	SHIMADZU UW420H	3
7	Chemistry apparatus Lakeside Cement, NICHKA LC-12 Canada Balsam	2
10	Accessories for Probe box TC-1	20
20	Stainless steel trays	20
4	Scoops (square type)	4
4	Scoops (small)	4
10	Spoon	10
10	Spatulas	10
5	Tweezers	5
10	Wash bottles	10

b. Conducting of short-term training in Mozambique  
- Content: The 5<sup>th</sup> short-term training in Mozambique will be conducted in similar way as the previous ones. However, the content of the training will be focused on equipment utilization training and equipment maintenance management using laboratory equipment procured.  
- Means: Lecturers of training are the relevant professor of the Akita University and the technical expert in this program. When conducting the training, present resources of the Universidade Eduardo Mondlane and the Instituto Superior Politecnico de Tete will be utilized. Furthermore, field excursion are also included in the training from the point of view to bring up the field geologists who are able to specialize in mineral resources for metal, oil and gas in the Universidade Eduardo Mondlane, and the engineers who are able to specialize in coal interpretation in the Instituto Superior Politecnico de Tete.

Area of the field training at the on-site work was a coal field in Tete Province where the Instituto Superior Politecnico de Tete exists.  
- Progress: Short-term training was held from 16 (TUE) May to 26 (FRI) May at the both universities. The lecturer were as follows:

- Mr. Koichi Tanaka, Japan Coal Energy Center (JCOAL)
  - Mr. Shusaku Miyaike, Mitsubishi Materials Techno Corporation (MMTEC)
  - Prof. Akira Imai, Akita University
  - Prof. Katsuyasu Sugawara, Akita University
  - Assist.Prof. Takahiro Kato, Akita University
- Training schedule and program are as Annex 3.

c. Revision of equipment utilization training manual (draft) and equipment maintenance management manual (draft)  
- Content: Contents of both the manuals (draft) will be updated by reflecting of feedback from participants of training.  
- Means: Both the manuals (draft) which created by participants of short-term training in Japan which was held on September to November in 2016 will be updated and revised after using provided equipment by JICA in the both universities.  
- Progress: Training using provided differential thermal analyzer provided by JICA in ISPT was focus on how to operate a decompression part for atmospheric gases, and revision were added to the equipment utilization training manual (draft) and equipment maintenance management manual (draft). The manual for creation of the thin sample which was created by participant from UEM has not been updated and revised, because equipment for thin sample preparation which has provided by SIDA had not completed an installation in the laboratory in UEM.

d. Holding of the Joint Coordination Committee (JCC) meeting  
- Content: JCC meeting will be held to review the progress of the project.  
- Means: The revised work plan will be discussed and the opinions on future policy will be exchanged in the committee meeting. And the present condition of the working group in the universities about connection with arrangement of the equipment will be also discussed by JCC.  
- Progress: JCC was performed at the time of the 5th On-site Work, and the work plan has been agreed. Minutes of this JCC is attached to Annex 4.  
e. Review of long-term training candidates  
- Content: The selection of members for long-term training will be considered in continuation with Phase 1.

<p>- Means: Selection of the long-term training candidates will be created based on the result of interviews and discussions.</p> <p>- Progress: An interview with 6 candidates for long-term training that will be commenced in 2018 was conducted at UEM with Prof. Akira Imai, Akita University. To hold hearing regarding study theme in UEM and that will be conducted in Japan, validity of the laboratory and these main target of research in the university in Japan for each candidates was discussed and confirmed.</p> <p>Whereas in ISPT, it was under consideration about candidates selection for long-term training.</p> <p>(3) The 5th domestic work (June 2017 to September 2017)</p> <p>a. Implementation of short-term training in Japan</p> <p>- Content: The short-term training in Japan was coordinated and conducted. The participants of the training are targeted for the lectures and laboratory staff involved in practical operations of research or laboratory equipment, and the lectures involved in curriculum improvement work at both universities.</p> <p>- Means: The training will be conducted mainly at Akita University, which has entered into an academic exchange agreement with the Eduardo Mondlane University and the Instituto Superior Politecnico de Tete, respectively. Training also will be held at other universities and mine site at etc.</p> <p>- Progress: Five persons involved in the both universities were invited to the training in Japan during from July 3 (MON) to July 28 (FRI), 2017. List of participants, schedule and program of the training are shown on Annex 5. The training for X-ray diffraction analysis for trainees from the Eduardo Mondlane University, and the training for a proximate analysis of coal sample by using differential thermal analyzer and its maintenance for trainees from the Instituto Superior Politecnico de Tete were conducted, respectively.</p> <p>b. Creation and Revision of equipment utilization training manual (draft) and equipment maintenance management manual (draft)</p> <p>- Content: The manuals (draft), which have been created by laboratory technical staff and lecturers by the 5<sup>th</sup> On-site work, will be revised. Equipment maintenance management manual (draft) and new equipment utilization training manual also will be created. And then, these manuals (draft) will be compiled as the manuals (draft) at the time of phase 2 - part 2.</p> <p>- Means: Revision of training manual (draft) is intended for the proximate analysis by using differential thermal analyzer. Professors of the Japanese side in Akita University point out details about technical contents of the correction and revision to the person in charge of</p>
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<p>the equipment through consultant. On the other hand, creation of new manuals (draft) are intended for the maintenance management of the differential thermal analyzer and mineral determination by X-ray diffraction analysis. These manuals are created by trainee through preparation of sample and operation of equipment by themselves.</p> <p>- Progress: Revision of training manual (draft) of the proximate analysis by using differential thermal analyzer which had been created by the 5<sup>th</sup> On-site work was done by adding coal classification categories, procedure and calculation using results of proximate analysis. And also, the maintenance management manual (draft) of the differential thermal analyzer was created by trainee from the Instituto Superior Politecnico de Tete. In addition, training manual (draft) of X-ray diffraction analysis containing basic principles of X-ray diffraction, sample preparation, operation of equipment and method of mineral determination was created by trainee from the Eduardo Mondlane University.</p> <p>c. Implementation of assistance for long-term trainees</p> <p>- Content: Six JICA long-term trainees from Mozambique (a lecturer of the Universidade Eduardo Mondlane, an engineer of Empresa Nacional de Hidrocarbonetos, an officer of National Institute of Mine, and three graduates from the Universidade Eduardo Mondlane) are presently in Japan for the long-term training under the training program for human resources development in the mining sector called Kizuna Program. Furthermore, in September, a lecturer of the Universidade Eduardo Mondlane and a lecturer of Instituto Superior Politecnico de Tete have come to Japan, who were selected after commencement of this project.</p> <p>- Means: Long-term trainees has chances to be allowed to join in the activities of the short-term training in Japan. And at the short-term training in Japan, we meet long-term trainees and hear from them about their academic life and their needs of assistance.</p> <p>- Progress: During the short-term training in Japan held from July 3rd to July 28th, three long-term trainees (graduates from Universidade Eduardo Mondlane), who were studying at Akita University, were allowed to participate in the field trip, from July 13th to July 15th, with short-term trainees. Also a long-term trainee who was studying at Hokkaido University, joined in the site visit at the Hokuryo Bibai open-pit coal mine at Bibai City with the short-term trainee. And, a long-term trainee (the lecturer of Universidade Eduardo Mondlane) studying at Kyoto University met the short-term trainee, his senior, during the short-term training in Japan.</p> <p>According to our communication with long-term trainees during the short-term training in Japan, they were all well and enjoy their academic life at their universities in Japan. Also, they were communicating well with their professors in charge.</p>
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<p><b>1-3 Achievement of Output</b> • <i>be currently in progress</i></p> <p><b>1-4 Achievement of the Project Purpose</b> • <i>be currently in progress</i></p> <p><b>1-5 Changes of Risks and Actions for Mitigation</b> • <i>There are no special considerations at the present moment.</i></p> <p><b>1-6 Progress of Actions undertaken by JICA</b> Contents to be adjusted by JICA side hereafter consist of a coordination for dispatch professors of Akita University to Mozambique at the 6<sup>th</sup> On-site training, travel coordination of the participants for the 4<sup>th</sup> short-term training in Japan in 2018, and travel and other coordination related to long-term trainee. Of these coordination, travel coordination will be implemented after discussion with both universities in the 6<sup>th</sup> On-site Work. Regarding coordination of travel for the long-term training, it is also included coordination with Kizuna Program for human resources development of mineral resources and the coordination is being carried out as needed.</p> <p><b>1-7 Progress of Actions undertaken by Universidade Eduardo Mondlane (UEM) and Instituto Superior Politecnico de Tete (ISPT)</b> Content under consideration at the Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete at the moment is the next three items. - Selection of candidates for a long-term training - Preparation for creation of utilization and maintenance management manual for equipment. - Installation of donated equipment by SIDA (Universidade Eduardo Mondlane)</p> <p><b>1-8 Progress of Environmental and Social Considerations (if applicable)</b> • <i>There are no special considerations at the present moment.</i></p> <p><b>1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)</b> • <i>There are no special considerations at the present moment.</i></p> <p><b>1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors,</b></p>
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<p><b>NGOs etc.)</b> • <i>There are no special considerations at the present moment.</i></p> <p><b>2 Delay of Work Schedule and/or Problems (if any)</b> • <i>There are no special considerations at the present moment.</i></p> <p><b>3 Modification of the Project Implementation Plan</b> • <i>There are no special considerations at the present moment.</i></p> <p><b>4 Preparation of Related Organizations toward after completion of the Project</b> • <i>There are no special considerations at the present moment.</i></p>
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**TO CR of JICA MOZAMBIQUE OFFICE**

**PROJECT MONITORING SHEET**

**Project Title: The Project on Capacity Development in Mineral Resources Sector**  
**Version of the Sheet: Ver.6 (Term: OCT. 2017 - MAR. 2018)**

**Name: Koichi TANAKA**

**Title: Chief Advisor**

**Submission Date: MAR. 20, 2018**

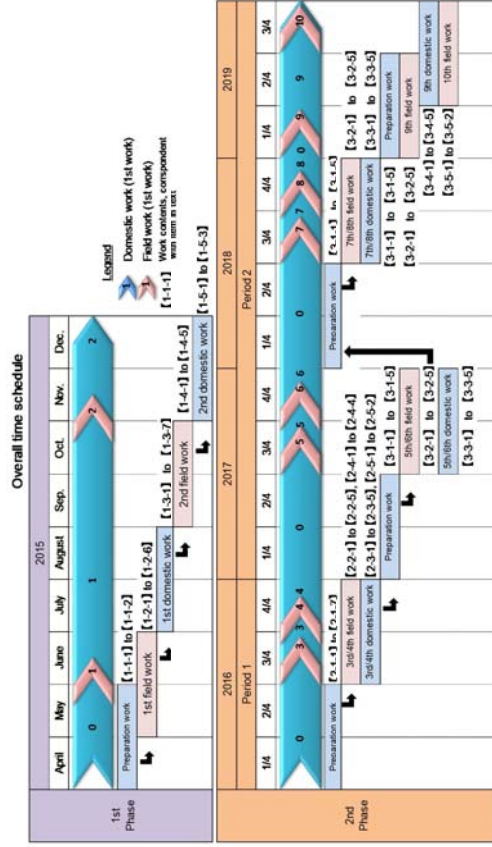
**I. Summary**

**1 Progress**

**1-1 Progress of Inputs**

An input is scheduled items based on the PDM which was created based on agreement among parties concerning this program. Short-term training program and equipment provision have been carried out now. Eleven peoples as long-term trainees have been accepted into relevant universities in Japan so far. The PDM is attached as Project Monitoring Sheet 1.

Over all time schedule is shown in below table.



**1-2 Progress of Activities**

1-2-1 Phase 2 - part 2

(1) The 5th domestic work (June 2017 to September 2017)

a. Creation and submission of Monitoring Sheet (September 2017)

- Content: Consultant team summarizes the activities during April 2017-September 2017 and reports the progress situation of this project.

- Means: Consultant team prepare Monitoring Sheet according to the designated form of JICA.

- Progress: Monitoring Sheet for April 2017-September 2017 was created as Annex 1.

(2) The 6th On-site Work (October to November 2017)

a. Conducting of short-term training in Mozambique

- Content: The 6<sup>th</sup> short-term training in Mozambique will be conducted in similar way as the previous ones. However, the content of the training will be focused on equipment utilization training and equipment maintenance management using laboratory equipment procured.

- Means: Lecturers of training are the relevant professor of the Akita University, Kyushu University and the technical expert in this program. When conducting the training, present resources of the Universidade Eduardo Mondlane (UEM) and the Instituto Superior Politecnico de Tete (ISPT) will be utilized. To support of development of expert for economic geology from UEM and of expert for coal analysis and its interpretation from ISPT, the model lectures including basic principle to latest application study will be conducted by professor of Akita University and Kyushu University.

- Progress: Short-term training was held from 30 (MON) October to 9 (THU) November in 2017 at the both universities. The lecturer were as follows:

Mr. Koichi Tanaka, Japan Coal Energy Center (JCOAL)

Mr. Shusaku Miyaike, Mitsubishi Materials Techno Corporation (MMTEC)

Prof. Akira Imai, Kyushu University

Prof. Katsuyasu Sugawara, Akita University

Assist.Prof. Takahiro Kato, Akita University

Assist.Prof. Ryohei Takahashi, Akita University

Training schedule and program are as Annex 2.

b. Revision of equipment utilization training manual (draft) and equipment maintenance management manual (draft)

- Content: Contents of both the manuals (draft) will be updated by reflecting of feedback from participants of training.

<p>- Means: Both the manuals (draft) which created by participants of short-term training in Japan which was held on July in 2017 will be updated and revised after using provided equipment by JICA in the both universities.</p> <p>- Progress: Training using provided differential thermal analyzer provided by JICA in ISPT was focus on maintenance of the equipment especially for cleaning of O-ring and parts, and revision were added to the equipment utilization training manual (draft) and equipment maintenance management manual (draft). In UEM, creation of the new manual for stereoscope was conducted. On the other hand, the manual of the thin sample which was created by participant from UEM has not been updated and revised, because equipment for thin sample preparation which has provided by SIDA had not completed an installation in the laboratory in UEM. The manual of the mineral determination using X-ray diffraction analyzer which was also created on short-term training in Japan on July in 2017 was checked and confirmed to need not revise on the current situation.</p> <p>c. Review of long-term training candidates</p> <p>- Content: The selection of members for long-term training will be considered in continuation with Phase 1.</p> <p>- Means: Selection of the long-term training candidates will be created based on the result of interviews and discussions.</p> <p>- Progress: An interview with 5 candidates for long-term training that will be commenced in 2018 was conducted at UEM with Prof. Akira Imai, Kyushu University and Assist.Prof. Ryohei Takahashi, Akita University. To hold hearing regarding study theme in UEM and that will be conducted in Japan, validity of the laboratory and these main target of research in the university in Japan for each candidates was discussed and confirmed.</p> <p>Whereas in ISPT, it was under consideration about candidates selection for long-term training.</p> <p>(3) The 6th domestic work (December 2017)</p> <p>a. Revision of equipment utilization training manual (draft) and equipment maintenance management manual (draft)</p> <p>- Content: The manuals (draft), which have been created by laboratory technical staff and lecturers by the 6<sup>th</sup> On-site work, will be revised. And then, these manuals (draft) will be compiled as the manuals (draft) at the time of phase 2 - part 2.</p> <p>- Means: Revision is intended for the training manual (draft) of the proximate analysis by using differential thermal analyzer, maintenance manual (draft) of differential thermal analyzer, manual (draft) for the mineral determination using X-ray diffraction analyzer and manual (draft) for stereoscope. Professors of the Japanese side in Akita University and</p>
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<p>Kyushu University point out details about technical contents of the correction and revision to the person in charge of the equipment through consultant.</p> <p>- Progress: Revision of each manual (draft) were conducted by the 6<sup>th</sup> On-site work, and will be continued on the On-site and domestic work which are planned. Revised manuals are as Annex 3.</p> <p>b. Creation and submission of Monitoring Sheet (March 2018)</p> <p>- Content: Consultant team summarizes the activities during October 2017 - March 2018 and reports the progress situation of this project.</p> <p>- Means: Consultant team prepare Monitoring Sheet according to the designated form of JICA.</p> <p>- Progress: Monitoring Sheet for October 2017 - March 2018 was submitted as this monitoring sheet.</p> <p><b>1-3 Achievement of Output</b></p> <p>- <i>be currently in progress</i></p> <p><b>1-4 Achievement of the Project Purpose</b></p> <p>- <i>be currently in progress</i></p> <p><b>1-5 Changes of Risks and Actions for Mitigation</b></p> <p>- <i>There are no special considerations at the present moment.</i></p> <p><b>1-6 Progress of Actions undertaken by JICA</b></p> <p>Contents to be adjusted by JICA side hereafter consist of a coordination for dispatch professors of Akita University and Kyushu University to Mozambique at the 7<sup>th</sup> On-site training, travel coordination of the participants for the 4<sup>th</sup> short-term training in Japan in 2018, and travel and other coordination related to long-term trainee.</p> <p>Of these coordination, travel coordination will be implemented after discussion with both universities in the 7<sup>th</sup> On-site Work. Regarding coordination of travel for the long-term training, it is also included coordination with Kizuna Program for human resources development of mineral resources and the coordination is being carried out as needed.</p> <p><b>1-7 Progress of Actions undertaken by Universidade Eduardo Mondlane (UEM) and Instituto Superior Politecnico de Tete (ISPT)</b></p> <p>Content under consideration at the Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete at the moment is the next three items.</p>
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<p>- Selection of candidates for a long-term training</p> <p>- Preparation for revision of utilization and maintenance management manual for equipment.</p> <p>- Installation of donated equipment by SIDA (Universidade Eduardo Mondlane)</p> <p><b>1-8 Progress of Environmental and Social Considerations (if applicable)</b></p> <ul style="list-style-type: none"><li>• <i>There are no special considerations at the present moment.</i></li></ul> <p><b>1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)</b></p> <ul style="list-style-type: none"><li>• <i>There are no special considerations at the present moment.</i></li></ul> <p><b>1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)</b></p> <ul style="list-style-type: none"><li>• <i>There are no special considerations at the present moment.</i></li></ul> <p><b>2 Delay of Work Schedule and/or Problems (if any)</b></p> <ul style="list-style-type: none"><li>• <i>There are no special considerations at the present moment.</i></li></ul> <p><b>3 Modification of the Project Implementation Plan</b></p> <ul style="list-style-type: none"><li>• <i>There are no special considerations at the present moment.</i></li></ul> <p><b>4 Preparation of Related Organizations toward after completion of the Project</b></p> <ul style="list-style-type: none"><li>• <i>There are no special considerations at the present moment.</i></li></ul>
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**TO CR of JICA MOZAMBIQUE OFFICE**

**PROJECT MONITORING SHEET**

**Project Title: The Project on Capacity Development in Mineral Resources Sector**  
**Version of the Sheet: Ver.5 (Term: APR, 2018 - SEP, 2018)**

**Name: Koichi TANAKA**

**Title: Chief Advisor**

**Submission Date: SEP, 2018**

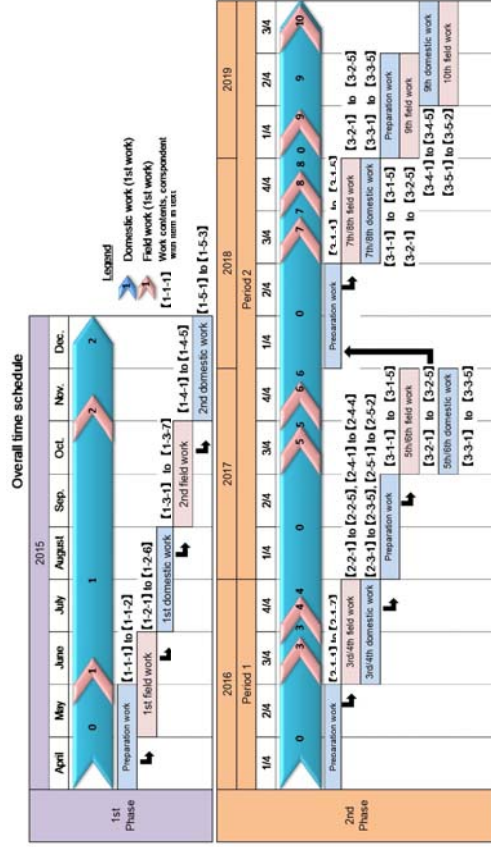
**I. Summary**

**1 Progress**

**1-1 Progress of Inputs**

An input is scheduled items based on the PDM which was created based on agreement among parties concerning this program. Short-term training program and equipment provision have been carried out now. Eleven peoples as long-term trainees have been accepted into relevant universities in Japan so far. The PDM is attached as Project Monitoring Sheet 1.

Over all time schedule is shown in below table.



**1-2 Progress of Activities**

1-2-1 Phase 2 - part 2

(1) Prior domestic work (January to May 2018)

a. Creation of an action policy for Phase 2 – part 2

- Content: An action policy for Phase 2 – part 2 will be created through discussion with Akita University and JICA.

- Means: Work plan for Phase 2 – part 2 will be revised as necessary based on discussion with Akita University, JICA and related organization in Mozambique.

- Progress: Action policy and the revised work plan were created in January, 2017. The policy has basically followed the planned content and schedule in the Phase 1.

b. Creation and submission of Monitoring Sheet (April 2018)

- Content: Consultant team summarizes the activities during October 2017-March 2018 and reports the progress situation of this project.

- Means: Consultant team prepares Monitoring Sheet according to the designated form of JICA.

- Progress: Monitoring Sheet for October 2017- March 2018 was created as Annex 1.

c. Consideration and planning of country-by-country training

- Content: Content of the country-by country training in the period of February -December, 2018 of the Phase 2 – part 2 will be considered and designed based on the actual training already conducted in the Phase 1 and Phase 2 – part 1.

- Means: Training in this period will basically follow the actual content in the Phase 1 and Phase 2 – part 1. However, donation of equipment have been completed at this point. For this reason, the training includes how to use the provided equipment. Consideration and planning for this training are carried out at the same moment of creation of the action policy for the Phase 2- part 2. The plan was made after sufficient consultation with Akita University in a similar way as Phase 1 and Phase 2 – part 1.

- Progress: Training content in the Phase 2 has been viewed and planned along with the creation of the work completion report of Phase 1 that was created in January 12, 2016. The content is shown in the training plan in relation to utilization of equipment as Annex 2.

(2) The 7th On-site Work (May to Jun 2018)

a. Conducting of short-term training in Mozambique

- Content: The 6<sup>th</sup> short-term training in Mozambique will be conducted in similar way as the previous ones. However, the content of the training will be focused on equipment utilization training and equipment maintenance management using laboratory equipment

<p>procured.</p> <p>- Means: Lecturers of training are the relevant professor of the Akita University, Kyushu University and the technical expert in this program. When conducting the training, present resources of the Universidade Eduardo Mondlane (UEM) and the Instituto Superior Politecnico de Tete (ISPT) will be utilized. To support of development of expert for economic geology from UEM and of expert for coal analysis and its interpretation from ISPT, the model lectures including basic principle to latest application study will be conducted by professor of Akita University and Kyushu University.</p> <p>- Progress: Short-term training was held from 28 (MON) May to 5 (TUE) Jun in 2018 at the both universities. The lecturer were as follows:</p> <p>Mr. Koichi Tanaka, Japan Coal Energy Center (JCOAL)</p> <p>Mr. Shusaku Miyaike, Mitsubishi Materials Techno Corporation (MMTEC)</p> <p>Prof. Katsuyasu Sugawara, Akita University</p> <p>Assist.Prof. Takahiro Kato, Akita University</p> <p>Training schedule and program are as Annex 3.</p> <p>b. Revision of equipment utilization training manual (draft) and equipment maintenance management manual (draft)</p> <p>- Content: Contents of both the manuals (draft) will be updated by reflecting of feedback from participants of training.</p> <p>- Means: Both the manuals (draft) which created by participants of short-term training on July 2017 in Japan and from October to November 2017 in Mozambique will be updated and revised after using provided equipment by JICA in the both universities.</p> <p>- Progress: Three kinds of samples of coal, which were carried from Japan, were analyzed for the understandings of i) cause of the difference of moisture content in the coals, ii) classification of the coals, and iii) correlative relationship between the volatile content and the degree of coalification by using provided differential thermal analyzer provided by JICA in ISPT. On the other hand, equipment of preparation for rock thin section donated by SIDA was installed in the place of laboratory in the UEM. Besides this, installed equipment has been used for the student experiment and so on in a normal way based on the experiences obtained by the past short-term training in Japan and Mozambique.</p> <p>c. Review of long-term training candidates</p> <p>- Content: The selection of members for long-term training will be considered in the same point of view as in past.</p> <p>- Means: Selection of the long-term training candidates will be made based on the result of interviews and discussions.</p>
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<p>- Progress: Interviews with 7 candidates in UEM and 3 candidates in ISPT for long-term training that will be commenced in 2019 were conducted. To hold hearing regarding study theme in UEM and that will be conducted in Japan, validity of the laboratory and these main target of research in the university in Japan for each candidates was discussed and confirmed.</p> <p>(3) The 7th domestic work (June 2018 to September 2018)</p> <p>a. Coordination of short-term training in Japan</p> <p>- Content: The 4<sup>th</sup> short-term training in Japan is coordinated and conducted. The intended participants of the training are the lectures and laboratory staff who are involved in practical operations of research or laboratory equipment, and the lecturer involved in curriculum revision work at ISPT.</p> <p>- Means: The training will be conducted mainly at Akita University, which has entered into an academic exchange agreement with the UEM and the ISPT, respectively. Training also will be held at other universities and mine site at etc.</p> <p>- Progress: Coordination of program and selection of participants for the short-term training in Japan were implemented. The period of short-term training was planned as 1 (MON) Oct to 26 (FRI) Oct, and the participants consist of 2 persons from UEM and ISPT respectively.</p> <p>b. Implementation of assistance for long-term trainees</p> <p>- Content: Seven JICA long-term trainees from an Mozambique (a lecturer of the UEM, two lecturers of ISPT, an engineer of , an officer of Mineral Resources Department, and three graduates from the UEM) are presently in Japan for the long-term training under the training program for human resources development in the mining sector called Kizuna Program.</p> <p>- Means: Long-term trainees has chances to be allowed to join in the activities of the short-term training in Japan. And at the short-term training in Japan, we meet long-term trainees and hear from them about their academic life and their needs of assistance.</p> <p>- Progress: A presentation meeting by present long-term trainees of the Kizuna Program was held on 31 (FRI) Aug 2018 at JICA in Japan. At that time, consultant team had interviews with three long-term trainees in Akita University, which all of trainees were graduated from the UEM and the one person's present post is the lecturer of the ISPT. According to our communication with long-term trainees during the short-term training in Japan, they were all well and enjoy their academic life at their universities in Japan. Also, they were communicating well with their professors in charge.</p>
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**1-3 Achievement of Output**

- *be currently in progress*

**1-4 Achievement of the Project Purpose**

- *be currently in progress*

**1-5 Changes of Risks and Actions for Mitigation**

- *There are no special considerations at the present moment.*

**1-6 Progress of Actions undertaken by JICA**

Contents to be adjusted by JICA side hereafter consist of a coordination for dispatch professors of Akita University to Mozambique at the 8<sup>th</sup> On-site training and travel and other coordination related to long-term trainee.

Regarding coordination of travel for the long-term training, it is also included coordination with Kizuna Program for human resources development of mineral resources and the coordination is being carried out as needed.

**1-7 Progress of Actions undertaken by Universidade Eduardo Mondlane (UEM) and Instituto Superior Politecnico de Tete (ISPT)**

Content under consideration at the Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete at the moment is the next three items.

- Selection of candidates for a long-term training
- Preparation for creation of utilization and maintenance management manual for equipment
- Preparation for amendment of curriculum

**1-8 Progress of Environmental and Social Considerations (if applicable)**

- *There are no special considerations at the present moment.*

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**

- *There are no special considerations at the present moment.*

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**

- *There are no special considerations at the present moment.*

**2 Delay of Work Schedule and/or Problems (if any)**

- *There are no special considerations at the present moment.*

**3 Modification of the Project Implementation Plan**

- *There are no special considerations at the present moment.*

**4 Preparation of Related Organizations toward after completion of the Project**

- *There are no special considerations at the present moment.*

**TO CR of JICA MOZAMBIQUE OFFICE**

**PROJECT MONITORING SHEET**

**Project Title: The Project on Capacity Development in Mineral Resources Sector**  
**Version of the Sheet: Ver.8 (Term: OCT. 2018 - MAR. 2019)**

**Name: Koichi TANAKA**

**Title: Chief Advisor**

**Submission Date: MAR. 2019**

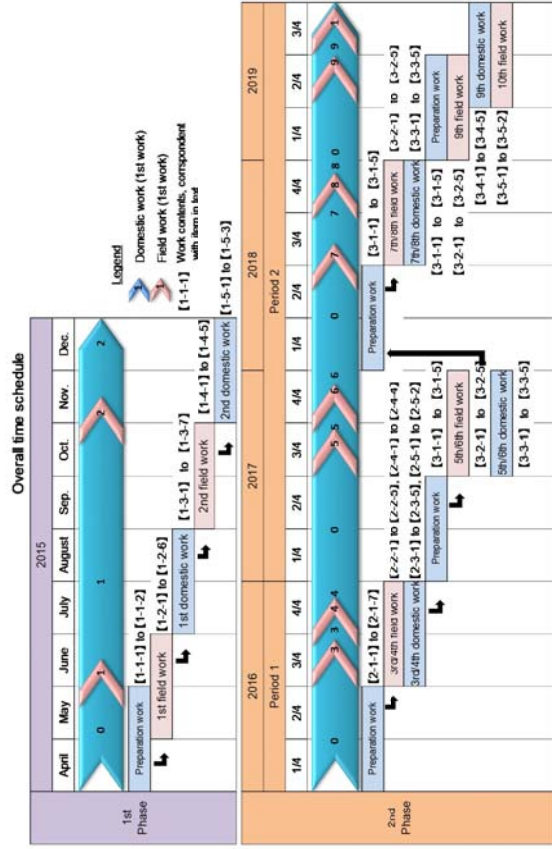
**I. Summary**

**1 Progress**

**1-1 Progress of Inputs**

An input is scheduled items based on the PDM which was created based on agreement among parties concerning this program. Short-term training program and equipment provision have been carried out now. Eleven peoples as long-term trainees have been accepted into relevant universities in Japan so far. The PDM is attached as Project Monitoring Sheet 1.

Over all time schedule is shown in below table.



**1-2 Progress of Activities**

1-2-1 Phase 2 - part 2

(1) The 7th domestic work (October 2018)

a. Creation and submission of Monitoring Sheet (September 2018)

- Content: Consultant team summarizes the activities during April 2018 - September 2018 and reports the progress situation of this project.

- Means: Consultant team prepares Monitoring Sheet according to the designated form of JICA.

- Progress: Monitoring Sheet for April 2018 - September 2018 was created as Annex 1.

(2) The 8th domestic work (October to November 2018)

a. Implementation of short-term training in Japan

- Content: The 4th short-term training in Japan was coordinated and conducted. The participants of the training are targeted for the lectures and laboratory staff involved in practical operations of research or laboratory equipment, and the lectures involved in curriculum improvement work at both universities.

- Means: The training will be conducted mainly at Akita University, which has entered into an academic exchange agreement with the Eduardo Mondlane University (UEM) and the Instituto Superior Politecnico de Tete (ISPT), respectively. Training also will be held at other universities and mine site at etc.

- Progress: Four persons involved in the both universities were invited to the training in Japan during from October 1 (MON) to October 26 (FRI), 2018. List of participants, schedule and program of the training are shown on Annex 2. The training for separation of Zircon and measurement by using XRD and SEM-EDS/CL that object to geochronology. Additionally, facility visits and interviews with relevant teachers were performed in Hokkaido University and Kyushu University, and mine and facility visit in relation to coal industry were also performed in private sectors.

b. Creation and Revision of equipment utilization training manual (draft) and equipment maintenance management manual (draft)

- Content: The manuals (draft), which have been created by laboratory technical staff and lecturers by the 7<sup>th</sup> On-site work, will be revised. Equipment maintenance management manual (draft) and new equipment utilization training manual also will be created. And then, these manuals (draft) will be compiled as the manuals (draft) at the time of phase 2 - part 2.

- Means: Revision is intended for the training manual (draft) of the proximate analysis by using differential thermal analyzer, maintenance manual (draft) of differential thermal



analyzer, manual (draft) for the prepare rock and mineral thin section, manual (draft) for the mineral determination using X-ray diffraction analyzer and manual (draft) for stereomicroscope. Professors of the Japanese side in Akita University point out details about technical contents of the correction and revision to the person in charge of the equipment through consultant. The lecture material (draft) of the chemical kinetics by using differential thermal analyzer and the lecture material (draft) of the separation of zircon by using stereomicroscope are created for new curriculum which is scheduled to start at both universities.

- Progress: The lecture material (draft) of i) the chemical kinetics by using differential thermal analyzer, ii) the element concentration analysis by titration analysis, iii) the principle, measurement and analysis by using carbon/sulfur analyzer, inductively coupled plasma atomic emission spectroscopy (ICP-AES) and atomic absorption spectrometer (AAS) was created by trainee from ISPT. The lecture materials (draft) of a procedure of the sample preparation of zircon and a method for utilizations of the X-ray diffraction analyzer, optical microscope and scanning electron microscope aiming for a radiometric dating using the zircon were created by trainee from UEM. Revised manuals are as Annex 3.

c. Implementation of assistance for long-term trainees

- Content: Six JICA long-term trainees from Mozambique (two lecturers of ISPT, an engineer of Empresa Mocambicana de Exploracao Mineira and three graduates from UEM) are presently in Japan for the long-term training under the training program for human resources development in the mining sector called Kizuna Program.

- Means: Long-term trainees has chances to be allowed to join in the activities of the short-term training in Japan. And at the short-term training in Japan, we meet long-term trainees and hear from them about their academic life and their needs of assistance.

- Progress: During the short-term training in Japan held from October 1st to October 26th, five long-term trainees (two from ISPT and three graduates from UEM), who were studying at Akita University, were interviewed. Additionally, an interview was also held with a trainee at Hokkaido University (from EMEM).

According to our communication with long-term trainees during the short-term training in Japan, they were all well and enjoy their academic life at their universities in Japan. Also, they were communicating well with their professors in charge.

(2) The 8th On-site Work (November 2018)

a. Conducting of short-term training in Mozambique

- Content: The 8<sup>th</sup> On-site work in Mozambique will be conducted in similar way as the

previous ones. However, the content of the training will be focused on equipment utilization training and equipment maintenance management using laboratory equipment procured.  
- Means: Lecturers of training are the relevant professor of the Akita University and the technical expert in this program. When conducting the training, present resources of UEM and ISPT will be utilized. To support of development of expert for economic geology from UEM and of expert for coal analysis and its interpretation from ISPT, the model lectures including basic principle to latest application study will be conducted by professor of Akita University.

- Progress: Short-term training was held from 19 (MON) November to 30 (FRI) November in 2018 at the university. The lecturer were as follows:

Mr. Koichi Tanaka, Japan Coal Energy Center (JCOAL)

Mr. Yoshimitsu Negishi, Mitsubishi Materials Techno Corporation (MMTEC)

Prof. Katsuyasu Sugawara, Akita University

Assist.Prof. Takahiro Kato, Akita University

Assist.Prof. Ryohei Takahashi, Akita University

Training schedule and program are as Annex 4.

Two trainings of i) reproducibility of proximate analysis of coal and ii) chemical kinetics of calcium oxalate by using differential thermal analyzer were conducted in ISPT. On the other hand, training of sample preparation and zircon piking for radiometric dating was conducted according to the existing manual which had created at short term training in Japan. However, some equipment and chemical agents are insufficient in the laboratory of UEM. Thus, procedure was changed using only the equipment etc. which can be used in UEM, and trainees were advised to revise the manuals (draft) by the lecturer.

b. Revision of equipment utilization training manual (draft) and equipment maintenance management manual (draft)

- Content: Contents of both the manuals (draft) will be updated by reflecting of feedback from participants of training.

- Means: Both the manuals (draft) which created by participants of short-term training on October 2018 in Japan and from May to June 2018 in Mozambique will be updated and revised after using provided equipment by JICA in the both universities.

- Progress: Minor amendment of the manuals in relation to experimental and training procedure was carried out to correct inappropriate descriptions about the mathematical formula in the existing manuals. On the other hand, other manuals created by trainees were prepared as a final version.

c. Review of long-term training candidates  
 - Content: The selection of members for long-term training will be considered in the same point of view as in past.  
 - Means: Selection of the long-term training candidates will be made based on the result of interviews and discussions.  
 - Progress: Interviews with each 1 candidate in UEM and ISPT for long-term training that will be commenced in 2019 were conducted. In the interview, through hearing regarding their study theme in UEM and ISPT and study theme they want to conduct in Japanese university, the validity of their research content as well as the laboratory at Japanese university to which each candidate would be accepted was confirmed.

d. Holding of the Joint Coordination Committee (JCC) meeting  
 - Content: JCC meeting will be held to review the progress of the project.  
 - Means: Current status of the project based on the initial work plan and tasks at commencement of Phase 2, current status of the training based on the donated equipment and instrument, and current status of activities by working group in universities based on the initial work plan will be discussed.  
 - Progress: JCC was performed at the time of the 8th On-site Work in which were carried out the explanation and consultation about actual progress of the project. In this meeting, further action during short to long term by universities was exchanged among participants based on the background, outcomes and challenges which have been obtained through the past training.

(3) Preliminary domestic work (January to March 2019)  
 a. Preparation of Training 2019  
 - Content: This project is going to finish on this 2019. Final training and seminar will be held during this year according to the scheduled plan.  
 - Means: Schedule of 9<sup>th</sup> On-site work in May and 10<sup>th</sup> On-site work including final seminar in September in Mozambique will be created based on the previously conducted content and background of past trainings.  
 - Progress: Creation of the plan is now in progress and the 9<sup>th</sup> On-site work in Mozambique is going to hold in May according to tentative plan. On the other hand, arrangements of the plan for the 10<sup>th</sup> work in Mozambique will be performed jointly with MIREME, UEM, ISPT and JICA Mozambique Office during the 9<sup>th</sup> On-site work in Mozambique.

**1-3 Achievement of Output**  
 • *be currently in progress*

**1-4 Achievement of the Project Purpose**  
 • *be currently in progress*

**1-5 Changes of Risks and Actions for Mitigation**  
 • *There are no special considerations at the present moment.*

**1-6 Progress of Actions undertaken by JICA**  
 Contents to be adjusted by JICA side hereafter consist of a coordination for dispatch professors of Akita University to Mozambique at the 9<sup>th</sup> On-site work and travel and other coordination related to long-term trainee.  
 Regarding coordination of travel for the long-term training, it is also included coordination with Kizuna Program for human resources development of mineral resources and the coordination is being carried out as needed.

**1-7 Progress of Actions undertaken by Universidade Eduardo Mondlane (UEM) and Instituto Superior Politecnico de Tete (ISPT)**  
 Content under consideration at the Universidade Eduardo Mondlane and Instituto Superior Politecnico de Tete at the moment is the next three items.  
 - Selection of candidates for a long-term training  
 - Final arrangement of utilization and maintenance management manual for equipment  
 - Preparation for amendment of curriculum

**1-8 Progress of Environmental and Social Considerations (if applicable)**  
 • *There are no special considerations at the present moment.*

**1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)**  
 • *There are no special considerations at the present moment.*

**1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)**  
 • *There are no special considerations at the present moment.*

**2 Delay of Work Schedule and/or Problems (if any)**

- *There are no special considerations at the present moment.*

**3 Modification of the Project Implementation Plan**

- *There are no special considerations at the present moment.*

**4 Preparation of Related Organizations toward after completion of the Project**

- *There are no special considerations at the present moment.*

III) Minutes of Joint Coordination Committee  
(JCC) Meeting

## Minutes of 2015 Joint Coordination Committee (JCC) for the Project on Capacity Development in Mineral Resources Sector

Date : May 29, 2015, Friday

Hours : 9:20~11:00

Venue : Meeting Room at DPD, MIREME

Participants :

MIREME : Mr. Francisco Luis Junior (Head, DPD)

Dr. Daud Liaee Jamal (Deputy Director, Institute of Geology and Mineral)

UEM : Dr. Estevão Sumburane (Head, Department of Geology)

ISPT : Dr. Bernardo Miguel Bene (Director General)

Embassy of Japan in Mozambique (observer) : Mr. Tetsuro Ito (First Secretary)

JICA Mozambique Office : Ms. Chiharu Morita (Senior Representative)

Mr. Issei Aoki (Representative)

Mr. Simões Victorino (Program Officer)

Mr. Koichi Tanaka (JCOAL), Mr. Yoshimitsu Negishi (MMTEC)

JICA Consultant : Ms. Akiko Abe (Interpreter and Coordinator)

### 1. Opening

All the participants made self-introduction themselves.

JICA Mozambique Office:

(Brief presentation about the JICA Project using attached presentation file was held.)

JICA Project on capacity development in mineral resources sector in Mozambique has started last year after the Record of Discussion between MIREM and JICA was signed in June, 2014.

So far, four long term trainees have come to Japan they are in the master course at Hokkaido University and doctor course at Kyoto University.

UEM:

About long term training, I would like to know the present situation of the number of students allowed and its breakdown.

JICA Mozambique Office:

The number of long term trainees allocated under the Project is twelve, four of which are allocated for postgraduate level program for educators in UEM and ISPT. Presently, one educator from UEM was dispatched for doctor course at Kyoto University and one educator from ISPT was dispatched for master course at Hokkaido University. Therefore, the remaining

number of students is two and those students can be master course student or doctor course student as long as qualified.

Remaining eight students are assigned to government officials. Two officials of MIREME are now studying in master course in Hokkaido University. The remaining number is six.

JICA also offers another scholarship program for master course called "ABE Initiative". The number of students allowed under this scheme is around thirty. The candidates for master course can utilize the ABE initiative.

\*(Remarks) After JCC meeting, JICA head office confirmed that the number allocated to government officers could be reallocated to educational institutions (UEM/ISPT).

UEM & ISPT:

We would like to know the timing of application for next long term training.

JICA Mozambique Office:

Long term training has started in 2014 and application forms are prepared for applicants of the first batch students. Now JICA is finalizing an application form for second batch this year. After finalization of the form, JICA will send the form to UEM, ISPT and MIREME with a specified deadline.

### 2. Work Plan

JICA Consultant explained the Work Plan by focusing on the content of implementation of the Program, namely short-term trainings and provision of laboratory equipment. The following matters were confirmed.

UEM & ISPT:

We understand the JICA Program and acknowledge the Work Plan. Our concern is that the allocated number for short-term training in Japan is five. Two universities will compete to get bigger number. The number for short-term training in Japan should be even number, namely six.

JICA Consultant:

We will convey your request to JICA Head office.

\*(Remarks) After this meeting, JICA Mozambique office inquired to Head office and Head office clarified that six educators could participate short-term training in Japan.

### 3. Working Team

JICA Consultant explained the purpose of formation of Working Team. And, two universities confirmed as follows;

UEM & ISPT:

Both universities understand about a necessity of Working Team and confirm the appointment of team members for cooperation with JICA Consultant about content of short-term training and selection of laboratory equipment to be provided and other important matters.

JICA Consultant:

We would like to discuss about member of Working Team with the both universities in the following week and would like to have the member list.

UEM & ISPT:

We confirm the request from JICA Consultant.

#### 4. Monitoring Sheet

JICA Consultant explained the purpose of drawing up of Monitoring Sheet and also told the date of filing to JICA and the template of the Sheet. And, two universities confirmed as follows;

JICA Consultant:

JICA Consultant firstly fills the necessary items in the template and then instructs the both universities to how to fill the remaining items and complete the template by correspondence with e-mails. Deadline of submission of the first Monitoring Sheet is end of September, 2015.

UEM & ISPT:

We confirm the drawing up of Monitoring Sheet. However, we do not know how to fill the template and then we will deal with the Sheet after we get the instruction from JICA Consultant.

#### 5. Short-term training

JICA Consultant:

Short-term training will be held twice a year, one in Japan and the other is in Mozambique for five years. The first Short-term Training in Japan will be held in October, 2015. The preliminary program is shown in Page 11 of Working Plan. And we will discuss contents of the program with Akita University and finalize the content, after a necessity survey through this mission.

About member of short-term training in Japan this year, we would like to request the both universities to choose the one member who is responsible or influential person to select laboratory equipment to be provided. The selection of laboratory equipment will be discussed during the short-term training in Japan.

We would like to also request UEM and ISPT a candidate list of short-term training course in Japan.

UEM & ISPT:

We confirm the request from JICA Consultant.

Will the content of short-term training be changed with the progress and further request from us?

JICA Consultant:

We will make necessary change and intend the improvement of the Training.

ISPT:

About member of short-term training in Japan, highly responsible person like me, a director, will have difficulty to attend whole three weeks program. Such a responsible member could attend a part of the training course?

JICA Consultant:

It will not be allowed, but we will inquire the matter to JICA Head Office in Japan.

#### 6. Long Term Training

JICA Consultant:

About a selection of educators or researchers of the Long Term Training, it is very important that what area of research or what kind of research candidate want to pursue. The research topic which he or she selects should be linked with future inter-university collaborative research. Please fully consider the research topic carefully.

It would be appreciated if you could show us the list of candidate in the following week.

UEM & ISPT:

We confirm the request of JICA Consultant.

#### 7. Closing

1) Q&A about laboratory equipment to be provided

JICA Mozambique Office:

If we procure the laboratory equipment from South Africa, for example, does the tax exemption apply or not? We understand taxes are exempted in this project because this project is a technical cooperation between both governments.

MIREME & ISPT:

The import of equipment for education purpose, tax exemption is always applied. When we receive the quotation of the equipment, we should submit a letter to the Ministry of Economy and Finance for its review.

## Minutes of 2016 Joint Coordination Committee (JCC) for the Project on Capacity Development in Mineral Resources Sector (Phase 2)

2) Confirmation of the subsequent schedule  
JICA Consultant:

About schedule of next JCC, it will be held at MIREME in November, 2015.

MIREME, UEM & ISPT:

For ISPT, it is a bit difficult to come from Tete all the way. But ISPT confirms our participation, so, let us know the date of the meeting as soon as possible.

JICA Consultant:

We confirm your request.

3) Closing Remarks by MIREME

MIREME (Mr. Francisco Luis Junior):

We, MIREME, have very much appreciated the support to us from JICA, JOGMEC and JCOAL. We hope this JICA Project will be going well from now on.

Date : September 2, 2016, Friday

Hours : 9:00~12:00

Venue : 12<sup>th</sup> Floor Meeting Room at DPC, MIREME

Participants :

MIREME : Mr. Eugenio Simbine (Director Nacional)

Mr. Mahoque Luis Alberto (Technician, DPC)

UEM : Dr. Estevão Sumburane (Head, Department of Geology)

ISPT : Dr. Bernardo Miguel Bene (Director General)

Embassy of Japan in Mozambique (observer) : Mr. Koji Hanaawa (First Secretary)  
Mr. Yasuma Takao (Researcher / Adviser)

JICA Mozambique Office: Mr. Katsuyoshi Sudo (Chief Representative)

Ms. Chiharu Morita (Deputy Chief Representative)

Ms. Yayoi Arima (Representative (replace Mr. Tomura))

Mr. Simoes VICTORINO (Programmer Officer)

JICA Consultant : Mr. Koichi Tanaka (JCOAL), Mr. Yoshimitsu Negishi (MMTEC),  
Ms. Kyoko Tamai (Interpreter)

1. Opening

Firstly, all the participants made self-introduction themselves. Then, the aim of JCC and proceedings of the meeting were explained according to the agenda by JICA Consultant.

2. Status of procurement of laboratory equipment provided by JICA

JICA Consultant explained the contents of laboratory equipment to UEM and ISPT provided by JICA and the situation of procurement and transportation of equipment with papers.  
The following were discussed.

MIREME:

We deeply appreciate the provision of equipment. We expect it to be effectively put to use in Mozambique.

When will the effective use of these equipment begin for both universities?

JICA Consultant:

As for the Analytical instrument of ISPT, it will approximately take one year after being trained. The equipment for UEM is not complicate and can be used right away. However, the challenge for UEM is how and what kind of research and experiment will be carried out using

the equipment.

MIREME:

What exactly does it mean about exchanging some material due to transportation trouble? Will they have to make changes in training courses?

JICA Consultant:

It is resin and was identified as ignition dangerous goods during transportation. However, this will not cause any change with our plan.

MIREME:

How large will the economic effect be with the supply of equipment this time?

JICA Consultant:

For ISPT, if they will be able to analyze themselves with this analytical instrument, there will be possibility of receiving request of coal analysis from coal companies since coal fields are in this area. About UEM, and it will be able to cut down the cost for currently outsourcing on thin section preparation. Also it will speed up the research by using the instrument since observation of thin section preparation can be done right away.

The cost of equipment provided by JICA this time is approximately 14 million yen.

UEM:

To give a supplementary explanation, UEM's equipment is employed for student education and the new microscope is particularly valuable for this education.

For thin section preparation, settings of equipment supplied by SIDA is not yet settled down, but it will be done as soon as the repairs of roof and outlet are completed.

If we will be able to carry out thin section preparation themselves, the consignment of thin section preparation from outside will become possible.

MIREME:

I have understood the necessity of laboratory repair. It is difficult to dig up budget in the present condition of our country, but I will give what help I can.

3. Work plan

1) Work Plan explanation

JICA Consultant:

The matter modified for Phase 2 from the original plan is that we have increased the number

of short-term training in Mozambique. At previous year's stage, the number of training in Phase 2 was short-term training in Japan and in Mozambique was once a year respectively. The change has been made to twice a year for short-term training in Mozambique.

The reason for this change is that equipment training, which for UEM is thin section preparation, and proximate analysis for ISPT, is extremely important for both universities. Now, equipment itself concerning these laboratory works has been arranged to both universities, but, it has not been put into use at all.

From this situation, in order to acquire knowledge of handling these equipment through training, it is desirable that the equipment placed in both universities and equipment used in training in Japan should be almost similar. And, as the remaining term of this project is three years, the original plan of once a year for both training in Japan and in Mozambique was considered not enough.

We have made up the work plan considering it is primary matter that for UEM it will acquire the ability to make thin section preparation which is basis of geological research, and for ISPT it will be able to do proximate analysis which is basic of coal analysis of industrial analysis, will become primarily. Also, we have considered furthermore new curriculums for both universities based on these primary goal.

Unfortunately, we were not able to practice thin section preparation in the training this time in UEM. However, we checked laboratory assigned for thin section preparation and inspected research rooms with faculty where equipment provided by JICA will be set. Professor Mr. Imai's lecture was made yesterday earning twenty six people. Many questions and answers were made and was a great success. We will continue on training in this style.

We have received notice that the analytical instrument shipped out from Japan in early August have arrived to ISPT yesterday. We will start training by Professor Mr. Sugawara and Professor Mr. Kato.

Also in ISPT, we plan to have a lecture from Professor Sugawara and Professor Kato about coal analysis and related research

2) Short-term training & Coal policy training

JICA Consultant:

Participants short-term training in Japan were considered as a pair of a teacher and a technical staff for each university. We will have the teachers visit not only on Akita University, but also other universities to see the situation of mining & geology education and research. Technical staff will receive practical training at laboratory of Akita University through the term. We found out that one teacher and three technical staff will come to Japan this time.

In case of training in the University of Akita, we will have each technical staff draw equipment utilization manual and management manual in order for their own laboratory to handle the equipment on their own.



In addition, we have held coal policy training in Japan since this May through June. This training was held for MIREME officers. We operated this training for a month with extensive coal related lectures and site visits, etc. We expect the MIREME to make use of this training meaningfully.

MIREME:

I have fully understood the content and aim of short-term training in Japan and coal policy training. Speaking of trainees of short-term training in Japan, will different technical staff go to training in Japan every time?

JICA Consultant:

We assume that different technical staff will get training in Japan every time at this point.

MIREME:

Is not there any kind of stepping up training?

JICA Consultant:

We would like to consider taking look at the measure of acquisition through training this time. For instance, coal analysis after mastering proximate analysis, advances to ultimate analysis and the training of utilizing thin sections follows mastering thin section preparation. However a lot of know-how is necessary and it is considered to take about two to three years to just master these basic skills.

MIREME:

For the equipment provided by JICA, will there be a backup for maintenance of equipment or in need of new parts due to breakdown? This is highly concerned since this can occur any time.

JICA Consultant:

We basically have no budget for new parts or others in this program, but it might be possible to make adjustments for some spares within the training period. However, this will be within the program period.

JICA :

There will basically be no follow up, so we would like the university to make effort to appoint appropriate person to maintain equipment properly and secure budget to place equipment management in the university itself and keep equipment in good condition

UEM:

As for maintenance matters, it is not enough just exchanging parts because it is broken, and so, I would liked to request it to be included in the training, for example how often the filter needs to be changed, and such matters.

JICA:

We consider it important to adjust the maintenance framework. It is better to set a proper role sharing such as a user and maintenance people. Is this not the same in Japan, role sharing?

JICA Consultant:

Maintenance matter is covered in the training in Japan. As for maintenance, in Japan it is often held out by the researcher itself. There is knowledge needed in usage of experimental equipment and this know-how will be included in this training.

UEM:

In practice, there will be all sorts of conditions such as what to do when it breaks down, or what to do when the electric current is unstable, or how to handle when it holds heat. We would like you to teach us such matters.

JICA Consultant:

For that reason, professors from the University of Akita will come and give training in both universities this November. There will be confirmation of equipment usage condition, and drawing up of procedure manual by technical staff will be subsequently supported by them.

UEM:

When I visited Japan and looked around the laboratory, I was not allowed to touch parts of the equipment or told that I do not have to clean up. I would like our technical staff to practice all of the equipment operation and maintenance matter in the training in Japan without any care by instructors.

MIREME:

The content of coal policy training for MIREME officers was extremely well. However the training term was tight considering the content volume. If there will be such volume in the content of training, we would like to ask to make this type of training into several modules .

JICA Consultant:

Indeed, but coal policy training was originally a different project from this one. This training became included halfway of Phase I of this project.

This coal policy training is operated under that restriction, and all meaningful matters

incorporated within such a restricted period. However, it is very unfortunate that coal policy training ended by this year and no more in the next year and after.

MIREME:

This coal policy training was extremely well and having attended this training myself, I thought that content concerning mine environment was especially very good. We wish to pass on this content to other staffs in the same department or to other department staffs. In order to do that, is it possible for us to receive this training's video material or direction material?

JICA Consultant:

We will probably be able to hand you the materials afterwards. And, if you at MIREME want coal policy training to be continued, we suggest you to request it to JICA.

3) Long term training

JICA Consultant:

We will continuously follow up with current and coming long-term trainees who study in Japanese universities. It will almost be time selecting the coming years' long-term trainees. We would like to ask UEM and ISPT to continue to nominate those students.

UEM:

There were three applicants last year from UEM, but only one could go to Japan this time. I hear that there are fixed number of places for international students from Mozambique, so I hope to send all wishing applicants abroad. Moreover I want that more number of trainees for Master's course will be accepted. Young generations who become teachers all hope to go overseas from Master's course. If going overseas is from Doctor Course, such staff have a family and faces difficult situation to do so.

Moreover, it would be great to have some kind of research oriented short-term course other than going abroad, for graduated students.

JICA Consultant:

Indeed it is nice, but there is no such kind of short term course for this program. Also the two who were rejected their application, this is University of Akita's condition and is not the applicant's problem. There were slightly differences in the specialty of the applicants desire and the specialty that the instructors at the University of Akita can correspond.

Therefore, it is best to consult with the university before the application will be made next time.

UEM:

Next time we will discuss thoroughly with the Japanese university in advance.

JICA Consultant:

During the training course in Japan starting in the end of September, we will visit other universities as well as Akita University. At this chance, it is better to gather information about studying themes through hearing to the Japanese university's teachers and then based on these information candidates should communicate Japanese university professors and make application.

4. Others

UEM:

We have consulted to JICA about candidate of doctoral course, and has there been any progress? There is one applicant who was not finished with masters program at last years stage. He has now completed masters course, so he can apply officially this time for a doctoral course.

JICA:

We are now under consideration about the matter.

5. Closing remarks

MIREME:

We highly appreciate this JICA project. And this was a valuable meeting that it made it possible for us to exchange opinions with JICA and the Japanese Embassy, and enabled us to confirm the next three years of action and challenges. We wish all peoples involved in this project take large steps.

We were able to confirm further utilization of equipment provided by JICA for this program, and also able to confirm the linkage with trainings.

It is extremely a big success that two Mozambiquan universities, UEM and ISPT that are fulfilling important roles in the field of mineral resource, are participating in this project.

We continue effort to overcome challenges and expand activities in the mineral resource field. Our country is currently making a master plan for coking coal development, and we could confirmed that the content of JCC discussion and the activity of our master plan is the same direction. In order to realize this master plan, we expect to make the best out of the target persons of this capacity development program.

We will firmly support the project so that the work plan presented this time will be carried out.

## Minutes of 2017 Joint Coordination Committee (JCC) for the Project on Capacity Development in Mineral Resources Sector (Phase 2)

Date : May 15, 2017, Monday

Hours : 13:00~15:00

Venue : Meeting room at JICA Mozambique Office

Participants :

MIREME : Mr. Mahoque Luis Alberto (Technician, DPC)

UEM : Dr. Estevão Sumburane (Head, Department of Geology)

ISPT : Dr. Bernardo Miguel Bene (Director General)

JICA Mozambique Office: Mr. Katsuyoshi Sudo (Chief Representative)  
Mr. Hidetake Aoki (Deputy Chief Representative)

Mr. Hiroyuki Tomura (Representative)

Mr. Simoes VICTORINO (Programmer Officer)

Akita University: Dr. Akira Imai (Professor)

JICA Consultant : Mr. Koichi Tanaka (JCOAL), Mr. Shusaku Miyaike (MMTEC)  
Ms. Kyoko Tamai (Interpreter)

### 1. Opening

Firstly, the aim of JCC and proceedings of the meeting were explained according to the agenda by Mr. Simoes VICTORINO. Mr. Sudo, JICA, made opening remarks in Portuguese. Mr. Mahoque Luis Alberto, MIREME made a speech, and he expressed his appreciation for this project's contribution to human development in mineral resources sector.

### 2. Situation of laboratory equipment provided by JICA

JICA Consultant explained the contents of laboratory equipment to UEM and ISPT provided by JICA and the situation of equipment with papers.  
The following were discussed.

MIREME:

The engineer of our department visited ISPT and confirmed the installed equipment provided by JICA. We will visit UEM to see the equipment provided by JICA at a later date.

UEM:

The equipment was supposed to be delivered last November, however, customs clearing of equipment needed a bit longer days and we received equipment last December.

And the thin section preparation equipment provided by SIDA was not set up yet. At the begging of use of the equipment, engineer of equipment dealer in South Africa will come to

instruct the usage of equipment after the equipment will be set up.

JICA:

When repairing work of the roof of laboratory will be completed?

UEM:

Repairing work was not finished yet, but it seemed to me last Friday that restoring work looks nearly completed.

### 3. Short-term training

#### 1) Short-term training in Mozambique

JICA Consultant explained the schedule of this time Short-term training in Mozambique with paper. For UEM, we will take out equipment from the boxes containing equipment and do the inspection of delivered goods. And we will do installation work of two microscopes. And Dr. Imai, Akita University, will deliver special lecture.

And for ISPT, we will do inspection of equipment to identify the cause of trouble and give instruction of usage for the equipment and deliver special lecture by Dr. Sugawara, and field work.

ISPT:

Is it the same location as last November about the field work?

JICA Consultant:

We will do field work on the same route as last November, but plan to do different work content.

UEM:

We need the information of the content of special lecture to notify to the department.

MIREME:

We heard that when the MIREME engineer inspected the equipment provided by JICA, he identified the needed peripherals.

JICA Consultant:

We do investigate the situation of the peripherals needed for equipment provided by JICA with Dr. Sugawara and Dr. Kato.

JICA:

Dr. Yoshitaka Hosoi, Senior Advisor of JICA, will visit ISPT and other in Tete on May 27~29 and visit UEM, and MIREME and others in Maputo on May 29-31.

course degree at the university in Norway, as a long-term trainee so as to study doctor course in Japan.

Dr. Imai, Akita University:  
According to my knowledge, I think he should apply to Kyoto University or Kyushu University.  
I met eight applicants for long-term trainees last November. Two of them already came to Japan this March. And I recommended the other one candidate, Mr. Pedro Joao Uaite Chuva, as a government-sponsored foreign student to Ministry of Education, Culture, Sports, Science and Technology (MEXT).

ISPT:  
Could you let me know the number of long-term trainees allocated to Mozambique?

JICA:  
We will make inquiry to JICA head office.

Dr. Imai, Akita University:  
Other than Kizuna project for sponsored foreign studying, there are ABE Initiative, MEXT government-sponsored foreign student.

5. Work plan  
JICA Consultant:  
Work Plan (2017) basically follows the Work Plan (2016). We will have short-term training in Mozambique twice and short-term training in Japan once a year. Through these trainings we (1) provide guidance on improvement in the curriculum, (2) provide guidance to lecturing through model lectures by experts and (3) provide guidance on the usage and maintenance management method of provided equipment.

MIREME:  
I would like to request you to send the electronic file of the table in Chapter 4.

ISPT:  
I would like to request that professor and lecturer can participate in short-term training in Japan with shorter period next time. So, we would like to ask you to consider our request in 2018.  
And new curriculum, which includes change of term of education from four years to five years needed for graduation, will be implemented in 2019..

## 2) Short-term training in Japan

JICA Consultant explained the schedule of Short-term training in Japan with paper.  
About practical training, technical staff will receive the training at laboratory of Akita University through the term. Content of practical training is X-Ray Diffraction (XRD) analysis for UEM and proximate analysis for ISPT. We will arrange for the teachers to visit not only on Akita University, but also other universities to investigate curriculum at Japanese universities and to see the situation of mining & geology education and research. Also teachers will visit mines, factories and other facility.

ISPT:  
We will dispatch Mr. Cossa and Mr. Banda, laboratory technical staff, again in order to fully acquire technical skill and knowledge of equipment and proximate analysis.

UEM:  
The schedule seems fine for us.

Dr. Imai, Akita University:  
Regarding XRD analysis, Dr. Takahashi is already preparing for the training.

4. Long-term training  
JICA Consultant:  
We hear that two long-term trainees from ISPT, who are Ms. Elsa Pansilvania Candre Manjate and Ms. Euclesia Paulina Francisco Cossa, will come to Japan in September to become Master course students at Akita University.

Dr. Imai, Akita University:  
Ms. Elsa Pansilvania Candre Manjate and Ms. Euclesia Paulina Francisco Cossa will be supervised by Dr. Kawamura and Imai respectively at Akita University. Though I was asked to do interview with them by JICA Head Office.

Dr. Imai, Akita University:  
Two long-term trainees from UEM, who already came to Akita University this March, will do field works in August and become officially master course students in September and do research relating field work.

UEM:  
There are many candidate students for JICA long-term trainees in UEM.  
Furthermore, I would like to request JICA to accept Mr. Jaono Unguana, who obtained master

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### JICA Consultant:

We will consider the request of shortening of training period for teacher at short-term training in Japan when we plan the schedule in 2018.

### MIREME:

Trainees of short-term training in Japan have got sufficient training of handling of equipment, however, it seems that they need to receive more training of maintenance of equipment. So, next time training of maintenance of equipment will be given more attention.

Another matter, consumables which commonly used in Japan happen to be difficult to get in Mozambique.

### Dr. Imai, Akita University:

In Japan, if we are able to get equipment by government assistance, university itself take care of maintenance of the equipment.

### 6. Closing remarks

JICA made closing remarks. He told it is important that people who have got trained under this project are playing active roles in Mozambique and their activities are provided feedback to JICA.

### MIREME:

I would like to request how to do rating of short-term trainees in Japan.

Date : November 30, 2018, Friday

Hours : 9:00~11:15

Venue : Meeting Room at Annex in MIREME

### Participants :

MIREME : Mr. Francisco Luis Junior (Department of Planning and Cooperation)

UEM : Dr. Daud Liace Jamal (Associate Professor, Department of Geology)

ISPT : Dr. Bernardo Miguel Bene (Director General)

JICA Mozambique Office: Mr. Hiroaki Endo (Chief Representative)

Mr. Hiroyuki Tomura (Representative)

Akita University: Dr. Ryohei Takahashi (Assistant Professor)

JICA Consultant : Mr. Koichi Tanaka (JCOAL), Mr. Yoshimitsu Negishi (MMTEC)

Ms. Kyoko Tamai (Interpreter)

### 1. Content

First of all, the schedule of this PJ is explained from the consultant side. The details of the training so far, the short-term training contents at Akita University in October, the current status of training and activities in ISPT and UEM, and the results so far were explained from the consultant. After that, the confirmation and exchanges of opinions between relevant persons were also carried out.

### 2. Discussion

#### ISPT:

Will short-term training be completed in 2019 and long-term training continue after that?

#### JICA Mozambique Office:

Study abroad as long-term training by Kizuna Program will continue for some time in the future.

#### ISPT:

There is a column to be filled out by the teacher in the application form when applying for the Kizuna. Until now, the information of the teacher in Japan was obtained by the support in this project. Also, the connection between ISPT and Akita University / Hokkaido University was obtained recently. In the future, will we receive contact-based support from JICA for creating networks with other universities of Japan? Because of we don't know which universities have what kind of teachers, and we need energies for looking for suitable teachers in Japan.

JICA Mozambique Office:

It is important to continue the network with universities at present, and from there, to expand the network to other teachers, universities, etc. according to the contents of research, etc. It is not easy for JICA to grasp what type of teaching staff exist in any university in Japan.

Francisco, MIREME: How do you think about short-term training from next year and later? Will there be without anything?

JICA Mozambique Office:

First, the short-term training in this project is ended, and the continuation of same project is not considered. We would like to request to securely maintain and use the donated equipment from JICA. In addition, we would like to hope to proceed with research activities under an agreement with Akita University, which we have already concluded. Based on this, the system of Kizuna will be utilized to continue research exchanges between teachers through Mozambican students in Japan. In this system, Japanese teachers can visit Mozambique for field works of the Mozambican students.

UEM:

Thank you again for this project. The laboratory capability has been improved by this project so far, and it is also expected to be utilized in the future. We are also grateful to this project to have instruct both of teachers and technicians on methods of sample pretreatment, etc. It was also a good opportunity to know the new concept of related research on lectures. On this basis, we believe that it would be better to continue a collaborative research with the Japanese side in the future. This project ends after this, however we would like to improve scientific research in the future. The new Strategy of UEM is to become a recognized laboratory not only in Southern Africa but also worldwide. On the other hand, we believe that it is important for UEM to advance research activities in order to scientifically solve problems in Mozambique, and this must be done. It would be very meaningful if we could cooperate with the Japanese side on research to solve such national problems. For example, there are issues related to domestic use of water. We are satisfying though this project, the main object in the project was universities, and on the other hand, the improvement of the levels for our staff and geological research institute is urgently required for MIREME as well. For this reason, we would like to ask for continued support from JICA.

JICA Mozambique Office:

We also have a great mission to support the resolution of issues in Mozambique. This is not only issues of the area of mineral resources, but also issues in the area of water. We explained earlier that there is no project same as this project, because we believe that this project basically fulfilled its purpose. JICA will continue to support UEM and ISPT. There was a presentation

meeting for the return of Mozambican students from Japan last day, and Dr. Magaia of UEM was also presented. Based on the meeting, we know that the network by international students is very important to connect with the university overseas. There are supports for hardware aspect such as laboratory, dam and so on in relation to this project, however software aspect including a creation of the relationship with researchers is most important in connection with the essential cooperation. While there are ABE Initiative in addition to Kizuna program regarding long-term training, ABE cooperates in business. In terms of improving the ability of university teachers, it is better for ABE to draw attention and apply for it. Training under the support by JICA has 60 courses/year, not only for the area of mineral resources, and we would like to ask MIREME to communicate such information to relevant universities and organizations. In applying to the trainings, it is important to secure well-qualified persons. However, it is better to apply for an international study/training program by utilizing networks in a tie-up with Akita University and so on.

MIREME:

I was also abroad in Waseda University for two years through ABE, but it was very nice experience.

JICA Consultant:

The deadline for applying to study abroad next year is in the middle of next month (December), and Dr. Bene says that he has already been holding the application form this time. So we would like to request the submission from UEM as soon as possible.

ISPT:

Whether it's ABE or Kizuna, could the JICA assist with the agreement with other universities besides Akita University? When I talked at the Symposium by Akita University in Tokyo this time, there was a chance to talk with other universities, and I felt the possibility of additional collaboration with another universities.

JICA Mozambique Office:

It doesn't support any particular inter-university agreement as a JICA. The reliability relationship by the network between universities is important, and it is considered that the agreement is concluded in the extension line.

ISPT:

So far we were grateful from Akita University, and recently, we became able to contact Hokkaido University in relation to long-term training. We would like to further expand the relationship, so we would like to have support for the first step of contacting the another

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universities.  
MIREME: It mean that we cannot contact to universities without knowing the professors in relation to our interest.

JICA Mozambique Office:

For this reason, the network is important, and if the other party is not a person who meets them (if there is no reliability relationship), they will not be accepted.

Dr. Takahashi, Akita University:

Even if a collaborative research is actually conducted, a research agreement, etc. can be concluded under the cultivation of a relationship related to the research. If this is an agreement between universities, the achievements of collaborative research up to that time, etc. are also required. Specifically, in terms of the connection with ISPT, Mr.Cossa is currently in our laboratory, and fieldwork is currently being carried out with Prof. Imai of Kyushu University. In that sense, it can be said that the networks which ISPT currently has are Akita University, Hokkaido University, and Kyushu University as well. Incidentally, there are many universities in Japan including the Department of Geology, among which the universities including the area of mineral resources are mainly composed of these three universities.

JICA Mozambique Office:

The agreement between universities is also very important, but the relation of Win-Win at that time would be also important. Based on this point, it is important to talk between universities. In addition, it is important in the future, but it is also important in the past. JICA will continue to observe whether the human resources development and donation of equipment will be properly managed and continued to operate in the future. We would like the MIREME to observe this, and then communicate with other organizations to inform the advantages of projects by JICA.

Date : November 15, 2019, Friday  
Hours : 9:00~11:00  
Venue : Meeting Room at Annex in MIREME

Participants :

MIREME : Mr. Antonio Eugenio Manda (Director, Department of Planning and Cooperation)  
Mr. Francisco Luis Junior (Department of Planning and Cooperation)

UEM : Dr. Elidio Massuanguanhe (Head, Department of Geology)

ISPT : Dr. Bernardo Miguel Bene (Director General)

JICA Mozambique Office: Mr. Hiroaki Endo (Chief Representative)

Mr. Roberty Zefánias (Program Officer)

Dr. Katsuyasu Sugawara (Professor)

Takahiro Kato (Assistant Professor)

Mr. Koichi Tanaka (JCOAL), Mr. Yoshimitsu Negishi (MMTEC)

Ms. Kyoko Tamai (Interpreter)

### 1. Contents

At first of all, consultant explained each item on the agenda. After this, working team exchanged opinions on the following five points, including questions and discussions.

- a) Checking the contents of activities (training) since the last JCC
- b) Checking the status of donated equipment (since last JCC)
- c) Confirmation of activity details up to now (2015 to 2010)
- d) Confirmation of the contents of the project completion report (final report)
- e) Approval of this project and final report contents

### 2. Questions and Discussions, etc.

MIREME:

The final seminar on last day was successful finalized and it were very nice presentations. We are very grateful to the JICA and the parties concerned for the successful implementation of this project, representing our Ministry. This project was made a largely contribution to related area in Mozambique. Through this project, it was very beneficial to provide experimental equipment to Mozambique and to conduct training and study abroad using similar equipment in Japan. Experiments in Mozambique are unavailable at the moment. At the same time, we believe that the laboratories on the Mozambique side have improved, making it realistic for the laboratories to be able to make budgets.

the doctoral course next year. The other person is preparing to enter the doctoral course at the moment. Both of them are working very hard, and they are also stimulating for Japanese students. Even if the donated equipment was caused various defects such as air conditioning in the room and carrier gas, it was related to the operation of the equipment at the beginning of delivery and installation. However, I am particularly grateful to the related persons to respond promptly and make improvements at all times, and that they were able to operate safely. Through these experiences, we believe that the provided equipment will be used with care in the future as well.

JICA Mozambique Office:

As mentioned by Mr. Manda, laboratory activities would be also serve as a tool for making budgets. In addition, technical support, which includes the provision and practical training of equipment and materials mentioned by UEM and ISPT, is a major feature of Japan's assistance styles. This project, which started in 2015, will be completed this time, but we would like you to keep the donated equipment and materials in the future and make further improvements. With regard to capacity continuation, it is very important to have a connection including joint research with overseas universities, etc. We plan to continue to support study abroad through Kizuna Program, and we would like to continue your relationship with Akita University and other universities.

3. Closing

JICA Mozambique Office:

This JCC was finally completed, however a thorough exchange of opinions was achieved through the final confirmation of the results. Although Mozambique and Japan have long been friendly to each other, we will continue our relationships in the future. JICA also emphasizes trends in the mineral resource sector. We would like to request that Mozambique side continues to enhance this area including other donors.

UEM:

We believe that our Department of Geology should be recognized internationally as a future vision. As part of this vision as explained in the seminar held yesterday, the establishment of a camp site in Manica and Tete as a geological training field, and enhancement of the research environment by construction of a new building including a laboratory are planned (the opening ceremony for construction of the new building has been implemented, and the construction is scheduled to commence in 2020). We would like to accept any other assistance or cooperation including JICA.

ISPT:

UEM:

Concerning the content explained, it is consistent with what has been done about UEM. What was nice in this project was that the program especially short-term training was implemented in combination with donated equipment and the training. The provided equipment was also included related reinforcement materials to reinforce the UEM laboratory. On the other hand, there are various views on the results of the plan shown in the PDM, but it is clear that the environment for education and research activities was certainly improved by training through the provision of equipment and materials. Students of graduation also actually use the stereoscopic mirror to carry out the research on the incorporation into the curriculum. On the other hand, even if the latter evaluation for actual condition of the maintenance in our laboratory might be low in the future, the reason may be due to the shortage of related materials. In Mozambique, there are many cases in which goods are not immediately received even if materials are ordered. As a reality, there are no stock of slide glass as a material related to thin plate preparation at present. We are ordering this glass, but we have not received yet. Therefore, it cannot be said that the reason for the performance degradation in the laboratory is capacity degradation. In any case, UEM will continue to firmly use the provided equipment, and feed back the knowledge and experience of teachers who have been trained or studied abroad in Japan to our university.

ISPT:

ISPT is also consistent with the content described. During this period, Prof.Sugawara of Akita University was given thorough guidance on the provided equipment to ISPT and its use. The same applies to the revision of the curriculum, and the content of practical training, etc. acquired in this project is incorporated into the curriculum scheduled to be revised in 2021. Though the result shown in PDM, etc. can not be said in general, it is clear that the education environment was certainly improved. In addition, there was also a great deal of connection with Japan, such as the agreement with Akita University and Hokkaido University. In the future, we would like to make academically public presentations at academic societies for some results of this project and research by foreign students. On the other hand, it is a difficult issue to secure a budget, but it will continue to make tries to secure it. For the time being, we would like to conduct outsourced analyses that can be done without international approval, and increase the ISPT's presence to secure budgets. We also wish to apply to the World Bank for a budget next year to further strengthen our laboratories.

Dr. Sugawara, Akita University:

Currently one student from UEM and one student from ISPT are accepted in our laboratory. One of them is going to study abroad from the master's process, and is scheduled to proceed to



We would like to be very grateful, including MIREME. As the future of the ISPT, it intends to commence the master's course in the near future. In relation to this, there are still three doctoral professors in ISPT, and we would like to increase the number of teachers who have doctorates in the future. In addition, ISPT will continue to make budgets for the donated equipment while using other existing equipment.

**MIREME:**

I believe that the mineral resources field in Mozambique will become affluent in the future and the human resources in this field will also be enriched. Japan has faithfully supported various countries since the past and is well aware that the country has become affluent as the result. Countries such as Malaysia, for example, are good examples. We were honestly asked to deal with this project as well. We hope that this area will be affluent by continuing the relationship, such as the continuing Kizuna Program. We are confident that this project has remain a recognizable achievement, and we are very grateful to the JICA and other parties concerned.

**4. Other**

Regarding the draft final report currently being implemented, Mozambique side checks the contents in the report and comment back to the consultant within November.