APPENDIX-7

DATABASE

Table A.7.1 Input Data for Geothermal Database

S/N	Classification	Test Type	Location	Measured by	Year	Remarks
1	Geological survey	Geological map	Aluto	METI	2010	Study on Geothermal Power Development Project in the Aluto Langano Field, Ethiopia
2	Geological survey	Geological map	Dallol, Boina	CNRS & CNR	????	Geological map of the Danakil Depression
3	Geological survey	Geological map	Tendaho, Damali, Danab, Meteka	CNRS & CNR	1975	Geological map of Central and Southern Afar
4	Geological survey	Geological map	Dofan	EMA	1993	Geological map of Debre Birhan
5	Geological survey	Geological map	Nazareth, Kone, Boseti, Gedemsa	GSE	????	Engineering Geological Map of Nazareth
6	Geological survey	Manifestation	13 sites	GSE	vary	Aluto, Danab, Dofan, Meteka, Teo, Fantale, Tendaho, Teo, Tulu Moye, Boseti, Gedemsa, Corbetti, Abaya
7	Geological survey	Manifestation	8 sites	JICA	2014	This study: Aluto, Gedemsa, Nazareth, Boseti, Kone, Dofan, Meteka, Tendaho
8	Remote sensing	Lineament	all	JICA	2014	This study
9	Remote sensing	Hydrothermal alternation	all	JICA	2014	This study
10	Remote sensing	Volcano	all	JICA	2014	This study
11	Remote sensing	Circular landform	all	JICA	2014	This study
12	Geophysical survey	MT survey	Aluto	METI	2010	Study on Geothermal Power Development Project in the Aluto Langano Field, Ethiopia
13	Geophysical survey	VES survey	Aluto	GSE	1982	
14	Geophysical survey	Gravity survey	Aluto	GSE	????	
15	Geophysical survey	Gravity survey	Abaya	GSE	????	
16	Geophysical survey	VES survey	Abaya	GSE	1983	
17	Geophysical survey	VES survey	Abaya	GSE	1993	
18	Geophysical survey	MT survey	Boseti	JICA & GSE	2014	This study
19	Geophysical survey	MT survey	Corbetti	RG	2012	Location only: Surface Exploration: Geology, geochemistry and resistivity report
20	Geophysical survey	Magnetic survey	Fantale	GSE	????	
21	Geophysical survey	Magnetic survey	Tulu Moye	GSE	????	
22	Geophysical survey	MT survey	Tendaho	JICA & GSE	2015	This study
23	Geophysical survey	MT survey	Tendaho	GSE	2014	Location only
24	Geophysical survey	MT survey	Tendaho	GSE	2013	ARGeo project
25	Geophysical survey	MT survey	Tendaho	GSE & BGR	2010~2012	Location only: GEOTHERM programme
26	Geophysical survey	MT survey	Tendaho	GSE & BGR	2006-2007	Location only: GEOTHERM programme
27	Geophysical survey	VES survey	Tendaho	Aquater	1980	
28	Geophysical survey	Magnetic survey	Tendaho	Aquater	1979	
29	Geophysical survey	Gravity survey	Tendaho	Aquater	1979	
30	Geophysical survey	Microseismic survey	Tendaho	Aquater	1995	Microseismic Survey Final Report
31	Geochemical survey	Geochemical analysis	8 sites	JICA	2014	This study: Aluto, Gedemsa, Nazareth, Boseti, Kone, Dofan, Meteka, Tendaho
32	Drilling survey	Drilling record*	Aluto	GSE	1982-1985	Final Drilling Report of LA-1~8
33	Drilling survey	Drilling record*	Aluto	GSE	????	Gradient well (IT-1~5)
34	Drilling survey	Drilling record*	Aluto	GSE	1982	Gradient well (TG-2~8,10~12)
35	Drilling survey	Drilling record*	Tendaho	Aquater	1994-95	TD-1~6 Drilling Report
36	Drilling survey	Drilling record*	Tendaho	Aquater	1980	Gradient well (GBH-1~9)

*Well Data includes location, curve, casing program, geological column and permeable zone, etc.
BGR: Bundesanstalt für Geowissenschaften und Rohstoffe
CNRS: Centre National de la Recherche Scientifique
CNR: Consiglio Nazionale delle Ricerche
EMA: Ethiopian Map Agency
METI: Ministry of Economy, Trade and Industry
RG: Reykjavík Geothermal

Well Logging Data in Aluto area

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
1	Well logging	Temperature logging	LA-1	Temperature	1982/10/14	1
2	Well logging	Temperature logging	LA-1	Temperature	1982/10/29	2
3	Well logging	Temperature logging	LA-1	Temperature	1983/1/20	3
4	Well logging	Temperature logging	LA-1	Temperature	1983/1/28	4
5	Well logging	Temperature logging	LA-1	Temperature	1983/7/7	5
6	Well logging	Temperature logging	LA-1	Temperature	1983/1/21	6
7	Well logging	Pressure test	LA-1	Pressure	1982/6/17	P2
8	Well logging	Pressure test	LA-1	Pressure	1982/6/25	P3
9	Well logging	Pressure test	LA-1	Pressure	1982/10/14	P5
10	Well logging	Temperature logging	LA-1	Temperature	1982/10/29	
11	Well logging	Temperature logging	LA-2	Temperature	1982/8/26	
12	Well logging	Pressure test	LA-2	Pressure	1982/11/15	
13	Well logging	Temperature logging	LA-3	Temperature	1983/3/19	T1
14	Well logging	Temperature logging	LA-3	Temperature	1983/3/19	T2
15	Well logging	Temperature logging	LA-3	Temperature	1983/3/20	T3
16	Well logging	Temperature logging	LA-3	Temperature	1983/4/29	T4
17	Well logging	Temperature logging	LA-3	Temperature	1983/5/5	T5
18	Well logging	Temperature logging	LA-3	Temperature	1983/5/6	T6
19	Well logging	Temperature logging	LA-3	Temperature	1983/5/6	T7
20	Well logging	Temperature logging	LA-3	Temperature	1983/5/7	T8
21	Well logging	Temperature logging	LA-3	Temperature	1983/5/9	T9
22	Well logging	Temperature logging	LA-3	Temperature	1983/5/10	T10
23	Well logging	Temperature logging	LA-3	Temperature	1983/5/10	T11
24	Well logging	Temperature logging	LA-3	Temperature	1983/5/17	T12
25	Well logging	Temperature logging	LA-3	Temperature	1983/5/18	T13
26	Well logging	Temperature logging	LA-3	Temperature	1983/5/19	T14
27	Well logging	Temperature logging	LA-3	Temperature	1983/5/20	T15
28	Well logging	Temperature logging	LA-3	Temperature	1983/6/13	T16
29	Well logging	Temperature logging	LA-3	Temperature	1983/6/14	T18
30	Well logging	Temperature logging	LA-3	Temperature	1983/6/16	T20
31	Well logging	Temperature logging	LA-3	Temperature	1983/6/17	T21
32	Well logging	Temperature logging	LA-3	Temperature	1983/6/17	T22
33	Well logging	Temperature logging	LA-3	Temperature	1983/6/18	T23
34	Well logging	Temperature logging	LA-3	Temperature	1983/6/19	T24
35	Well logging	Temperature logging	LA-3	Temperature	1983/6/22	T25
36	Well logging	Temperature logging	LA-3	Temperature	1983/6/25	T26
37	Well logging	Temperature logging	LA-3	Temperature	1983/6/28	T27
38	Well logging	Temperature logging	LA-3	Temperature	1983/7/2	T28
39	Well logging	Temperature logging	LA-3	Temperature	1983/7/10	T29
40	Well logging	Temperature logging	LA-3	Temperature	1983/7/16	T30
41	Well logging	Temperature logging	LA-3	Temperature	1983/8/1	T31
42	Well logging	Temperature logging	LA-3	Temperature	1983/8/6	T32
43	Well logging	Temperature logging	LA-3	Temperature	1983/8/15	T33
44	Well logging	Temperature logging	LA-3	Temperature	1983/8/29	T34
45	Well logging	Temperature logging	LA-3	Temperature	1983/9/14	T35
46	Well logging	Temperature logging	LA-3	Temperature	1983/9/26	T36
47	Well logging	Temperature logging	LA-3	Temperature	1983/10/4	T37
48	Well logging	Temperature logging	LA-3	Temperature	1983/10/8	T38
49	Well logging	Temperature logging	LA-3	Temperature	1983/10/11	T39
50	Well logging	Temperature logging	LA-3	Temperature	1983/10/17	T40
51	Well logging	Temperature logging	LA-3	Temperature	1983/10/27	T41
52	Well logging	Temperature logging	LA-3	Temperature	1983/11/2	T42
53	Well logging	Temperature logging	LA-3	Temperature	1983/11/10	T43
54	Well logging	Temperature logging	LA-3	Temperature	1983/11/24	T44
55	Well logging	Temperature logging	LA-3	Temperature	1983/11/29	T45
56	Well logging	Temperature logging	LA-3	Temperature	1983/12/3	T46
57	Well logging	Temperature logging	LA-3	Temperature	1983/4/25	T47
58	Well logging	Temperature logging	LA-3	Temperature	1984/4/30	T48

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
59	Well logging	Temperature logging	LA-3	Temperature	1984/5/2	T49
60	Well logging	Temperature logging	LA-3	Temperature	1984/5/3	T50
61	Well logging	Temperature logging	LA-3	Temperature	1984/6/8	T51
62	Well logging	Temperature logging	LA-3	Temperature	1984/6/12	T52
63	Well logging	Temperature logging	LA-3	Temperature	1984/6/19	T53
64	Well logging	Temperature logging	LA-3	Temperature	1984/12/21	Max. Therm.
65	Well logging	Temperature logging	LA-3	Temperature	1984/12/29	T54
66	Well logging	Temperature logging	LA-3	Temperature	1984/12/30	T54B
67	Well logging	Temperature logging	LA-3	Temperature	1985/1/8	T55
68	Well logging	Temperature logging	LA-3	Temperature	1985/4/21	T56
69	Well logging	Temperature logging	LA-3	Temperature	1985/6/23	T57
70	Well logging	Temperature logging	LA-3	Temperature	1985/7/2	T58
71	Well logging	Temperature logging	LA-3	Temperature	1985/7/4	T59
72	Well logging	Temperature logging	LA-3	Temperature	1985/7/6	T60
73	Well logging	Temperature logging	LA-3	Temperature	1985/7/10	T61
74	Well logging	WHP	LA-3	WHP	1984/6/15	WHP
75	Well logging	Pressure test	LA-3	Pressure	1983/3/20	P1
76	Well logging	Pressure test	LA-3	Pressure	1983/4/1	P2
77	Well logging	Pressure test	LA-3	Pressure	1983/4/29	P3
78	Well logging	Pressure test	LA-3	Pressure	1983/5/17	P4
79	Well logging	Pressure test	LA-3	Pressure	1983/6/13	P6
80	Well logging	Pressure test	LA-3	Pressure	1983/6/16	P9
81	Well logging	Pressure test	LA-3	Pressure	1983/6/17	P10
82	Well logging	Pressure test	LA-3	Pressure	1983/6/17	P11
83	Well logging	Pressure test	LA-3	Pressure	1983/6/15	P12
84	Well logging	Pressure test	LA-3	Pressure	1983/6/19	P13
85	Well logging	Pressure test	LA-3	Pressure	1983/6/21	P14
86	Well logging	Pressure test	LA-3	Pressure	1983/6/22	P15
87	Well logging	Pressure test	LA-3	Pressure	1983/6/25	P16
88	Well logging	Pressure test	LA-3	Pressure	1983/6/28	P17
89	Well logging	Pressure test	LA-3	Pressure	1983/7/10	P18
90	Well logging	Pressure test	LA-3	Pressure	1983/7/16	P19
91	Well logging	Pressure test	LA-3	Pressure	1983/8/1	P20
92	Well logging	Pressure test	LA-3	Pressure	1983/8/6	P21
93	Well logging	Pressure test	LA-3	Pressure	1983/8/15	P22
94	Well logging	Pressure test	LA-3	Pressure	1983/8/29	P23
95	Well logging	Pressure test	LA-3	Pressure	1983/9/14	P24
96	Well logging	Pressure test	LA-3	Pressure	1983/9/26	P25
97	Well logging	Pressure test	LA-3	Pressure	1983/10/4	P26
98	Well logging	Pressure test	LA-3	Pressure	1983/10/5	P27
99	Well logging	Pressure test	LA-3	Pressure	1983/10/8	P28
100	Well logging	Pressure test	LA-3	Pressure	1983/10/11	P29
101	Well logging	Pressure test	LA-3	Pressure	1983/10/17	P30
102	Well logging	Pressure test	LA-3	Pressure	1983/10/27	P31
103	Well logging	Pressure test	LA-3	Pressure	1983/11/2	P32
104	Well logging	Pressure test	LA-3	Pressure	1983/11/10	P33
105	Well logging	Pressure test	LA-3	Pressure	1983/11/24	P34
106	Well logging	Pressure test	LA-3	Pressure	1983/11/29	P35
107	Well logging	Pressure test	LA-3	Pressure	1983/12/3	P36
108	Well logging	Pressure test	LA-3	Pressure	1984/4/27	P37
109	Well logging	Pressure test	LA-3	Pressure	1984/4/29	P38
110	Well logging	Pressure test	LA-3	Pressure	1984/5/3	P39
111	Well logging	Pressure test	LA-3	Pressure	1984/5/4	P40
112	Well logging	Pressure test	LA-3	Pressure	1984/6/4	P41
113	Well logging	Pressure test	LA-3	Pressure	1984/6/5	P42
114	Well logging	Pressure test	LA-3	Pressure	1984/6/6	P43
115	Well logging	Pressure test	LA-3	Pressure	1984/6/8	P44
116	Well logging	Pressure test	LA-3	Pressure	1984/6/13	P45
117	Well logging	Pressure test	LA-3	Pressure	1984/6/19	P46

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
118	Well logging	Pressure test	LA-3	Pressure	1984/6/22	P47
119	Well logging	Pressure test	LA-3	Pressure	1984/12/30	P48
120	Well logging	Pressure test	LA-3	Pressure	1985/4/21	P49A
121	Well logging	Pressure test	LA-3	Pressure	1985/4/21	P49B
122	Well logging	Pressure test	LA-3	Pressure	1985/6/23	P50
123	Well logging	Pressure test	LA-3	Pressure	1985/7/2	P53
124	Well logging	Pressure test	LA-3	Pressure	1985/7/4	P54
125	Well logging	Pressure test	LA-3	Pressure	1985/7/6	P55
126	Well logging	Pressure test	LA-3	Pressure	1985/7/7	P55A
127	Well logging	Pressure test	LA-3	Pressure	1985/7/8	P55B
128	Well logging	Pressure test	LA-3	Pressure	1985/7/10	P56
129	Well logging	Pressure test	LA-3	Pressure	1987/12/29	P57
130	Well logging	Pressure test	LA-3	Pressure	1988/7/27	P58
131	Well logging	Temperature logging	LA-3	Temperature	2006/5/31	Kuster
132	Well logging	Temperature logging	LA-3	Temperature	2006/5/31	Kuster
133	Well logging	Pressure test	LA-3	Pressure	1985/7/14	Interference Test
134	Well logging	Pressure test	LA-3	Pressure	1983/6/15	Injection-Falloff
135	Well logging	Temperature logging	LA-3	Enthalpy	1985/4/28	Flow Test1
136	Well logging	Temperature logging	LA-3	WHP	1984/5/17	Flow Test2
137	Well logging	Pressure test	LA-3	Pressure	1984/5/17	Flow Test3
138	Well logging	Temperature logging	LA-3	Weir H	1984/5/17	Flow Test4
139	Well logging	Temperature logging	LA-3	WPH	1985/6/28	Flow Test5
140	Well logging	Temperature logging	LA-3	Total Mass Flow (T m	1985/6/28	Flow Test6
141	Well logging	Temperature logging	LA-3	Enthalpy	1985/6/28	Flow Test7
142	Well logging	Pressure test	LA-3	Pressure	1985/6/28	Flow Test8
143	Well logging	Pressure test	LA-3	Pressure	1984/6/4	Build-up Test1
144	Well logging	Pressure test	LA-3	Pressure	1985/7/1	Build-up Test2
145	Well logging	Temperature logging	LA-4	Temperature	1983/10/3	T1
146	Well logging	Temperature logging	LA-4	Temperature	1983/10/3	T2
147	Well logging	Temperature logging	LA-4	Temperature	1983/10/3	T3
148	Well logging	Temperature logging	LA-4	Temperature	1983/10/3	T4
149	Well logging	Temperature logging	LA-4	Temperature	1983/10/20	T5
150	Well logging	Temperature logging	LA-4	Temperature	1983/10/21	T6
151	Well logging	Temperature logging	LA-4	Temperature	1983/10/23	T7
152	Well logging	Temperature logging	LA-4	Temperature	1983/10/24	T8
153	Well logging	Temperature logging	LA-4	Temperature	1983/10/25	T9
154	Well logging	Temperature logging	LA-4	Temperature	1983/10/28	T10
155	Well logging	Temperature logging	LA-4	Temperature	1983/10/31	T11
156	Well logging	Temperature logging	LA-4	Temperature	1983/11/4	T12
157	Well logging	Temperature logging	LA-4	Temperature	1983/11/12	T13
158	Well logging	Temperature logging	LA-4	Temperature	1983/11/23	T14
159	Well logging	Temperature logging	LA-4	Temperature	1983/12/1	T15
160	Well logging	Temperature logging	LA-4	Temperature	1983/12/12	T16
161	Well logging	Temperature logging	LA-4	Temperature	1983/12/26	T17
162	Well logging	Temperature logging	LA-4	Temperature	1984/1/2	T18
163	Well logging	Temperature logging	LA-4	Temperature	1984/1/4	T19
164	Well logging	Temperature logging	LA-4	Temperature	1984/1/6	T20
165	Well logging	Temperature logging	LA-4	Temperature	1984/1/9	T21
166	Well logging	Temperature logging	LA-4	Temperature	1984/1/22	T22
167	Well logging	Temperature logging	LA-4	Temperature	1984/4/13	T23A
168	Well logging	Temperature logging	LA-4	Temperature	1984/4/14	T23B
169	Well logging	Temperature logging	LA-4	Temperature	1984/4/17	T24A
170	Well logging	Temperature logging	LA-4	Temperature	1984/4/18	T24B
171	Well logging	Temperature logging	LA-4	Temperature	1984/4/19	T25
172	Well logging	Temperature logging	LA-4	Temperature	1984/4/20	T26A
173	Well logging	Temperature logging	LA-4	Temperature	1984/4/20	T26B
174	Well logging	Temperature logging	LA-4	Temperature	1984/6/25	T27A
175	Well logging	Temperature logging	LA-4	Temperature	1984/6/27	T27B
176	Well logging	Temperature logging	LA-4	Temperature	1984/7/15	T28B

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
177	Well logging	Temperature logging	LA-4	Temperature	1984/10/9	T29
178	Well logging	Temperature logging	LA-4	Temperature	1984/10/30	T30
179	Well logging	Temperature logging	LA-4	Temperature	1985/3/26	T31
180	Well logging	Temperature logging	LA-4	Temperature	1985/4/2	T32
181	Well logging	Temperature logging	LA-4	Temperature	1985/5/15	T33
182	Well logging	Temperature logging	LA-4	Temperature	1985/5/17	T34
183	Well logging	WHP	LA-4	WHP	1985/1/27	WHP
184	Well logging	Pressure test	LA-4	Pressure	1983/9/21	P1
185	Well logging	Pressure test	LA-4	Pressure	1983/3/10	P2
186	Well logging	Pressure test	LA-4	Pressure	1983/10/21	P3
187	Well logging	Pressure test	LA-4	Pressure	1983/10/23	P6
188	Well logging	Pressure test	LA-4	Pressure	1983/10/24	P7
189	Well logging	Pressure test	LA-4	Pressure	1983/10/25	P8
190	Well logging	Pressure test	LA-4	Pressure	1983/10/26	P9
191	Well logging	Pressure test	LA-4	Pressure	1983/10/28	P10
192	Well logging	Pressure test	LA-4	Pressure	1983/10/31	P11
193	Well logging	Pressure test	LA-4	Pressure	1983/4/11	P12
194	Well logging	Pressure test	LA-4	Pressure	1983/12/11	P13
195	Well logging	Pressure test	LA-4	Pressure	1983/11/23	P14
196	Well logging	Pressure test	LA-4	Pressure	1983/1/12	P15
197	Well logging	Pressure test	LA-4	Pressure	1983/12/12	P16
198	Well logging	Pressure test	LA-4	Pressure	1983/12/23	P17
199	Well logging	Pressure test	LA-4	Pressure	1984/2/1	P18
200	Well logging	Pressure test	LA-4	Pressure	1984/4/1	P19
201	Well logging	Pressure test	LA-4	Pressure	1984/6/1	P20
202	Well logging	Pressure test	LA-4	Pressure	1984/1/22	P21
203	Well logging	Pressure test	LA-4	Pressure	1984/4/13	P22
204	Well logging	Pressure test	LA-4	Pressure	1984/4/16	P23
205	Well logging	Pressure test	LA-4	Pressure	1984/4/17	P24
206	Well logging	Pressure test	LA-4	Pressure	1984/4/21	P25
207	Well logging	Pressure test	LA-4	Pressure	1984/6/24	P26B
208	Well logging	Pressure test	LA-4	Pressure	1984/6/25	P27
209	Well logging	Pressure test	LA-4	Pressure	1984/6/27	P28
210	Well logging	Pressure test	LA-4	Pressure	1984/6/29	P29
211	Well logging	Pressure test	LA-4	Pressure	1984/7/14	P30
212	Well logging	Pressure test	LA-4	Pressure	1984/9/10	P31
213	Well logging	Pressure test	LA-4	Pressure	1985/3/27	P32
214	Well logging	Pressure test	LA-4	Pressure	1985/5/15	P33
215	Well logging	Pressure test	LA-4	Pressure	1987/12/24	P34
216	Well logging	Pressure test	LA-4	Pressure	1986/7/29	P35
217	Well logging	Temperature logging	LA-4	Temperature	2006/6/1	Kuster
218	Well logging	Pressure test	LA-4	Pressure	2006/6/1	Kuster
219	Well logging	Pressure test	LA-4	Pressure	1984/10/22	Injection-Falloff
220	Well logging	Temperature logging	LA-4	WPH	1984/11/27	Discharge Test1
221	Well logging	Temperature logging	LA-4	Flow Rate	1984/11/27	Discharge Test1
222	Well logging	Temperature logging	LA-4	Enthalpy	1984/11/27	Discharge Test1
223	Well logging	Pressure test	LA-4	Pressure	1984/6/4	Build-up test
224	Well logging	Temperature logging	LA-5	Temperature	1984/2/4	T1
225	Well logging	Temperature logging	LA-5	Temperature	1984/2/4	T2
226	Well logging	Temperature logging	LA-5	Temperature	1984/2/5	T3
227	Well logging	Temperature logging	LA-5	Temperature	1984/2/7	T4
228	Well logging	Temperature logging	LA-5	Temperature	1984/2/9	T5
229	Well logging	Temperature logging	LA-5	Temperature	1984/2/10	T6
230	Well logging	Temperature logging	LA-5	Temperature	1984/2/11	T7
231	Well logging	Temperature logging	LA-5	Temperature	1984/3/23	T8
232	Well logging	Temperature logging	LA-5	Temperature	1984/3/26	T9
233	Well logging	Temperature logging	LA-5	Temperature	1984/3/28	T10
234	Well logging	Temperature logging	LA-5	Temperature	1984/4/6	T11
235	Well logging	Temperature logging	LA-5	Temperature	1984/5/1	T12

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
236	Well logging	Temperature logging	LA-5	Temperature	1984/6/1	T13
237	Well logging	Temperature logging	LA-5	Temperature	1984/6/30	T14
238	Well logging	Temperature logging	LA-5	Temperature	1984/12/13	T15
239	Well logging	Temperature logging	LA-5	Temperature	1984/12/13	T-Max
240	Well logging	Temperature logging	LA-5	Temperature	1984/12/14	T16
241	Well logging	Temperature logging	LA-5	Temperature	1984/12/14	T17
242	Well logging	Temperature logging	LA-5	Temperature	1984/12/19	T18
243	Well logging	Temperature logging	LA-5	Temperature	1984/6/18	T19
244	Well logging	Temperature logging	LA-5	Temperature	1984/6/20	T20
245	Well logging	Temperature logging	LA-5	Temperature	1984/7/30	T21
246	Well logging	Temperature logging	LA-5	Temperature	1984/8/9	T22
247	Well logging	Pressure test	LA-5	Pressure	1984/3/14	P1
248	Well logging	Pressure test	LA-5	Pressure	1984/3/15	* P2
249	Well logging	Pressure test	LA-5	Pressure	1984/2/3	* P4
250	Well logging	Pressure test	LA-5	Pressure	1984/3/23	* P5
251	Well logging	Pressure test	LA-5	Pressure	1984/3/26	* P6
252	Well logging	Pressure test	LA-5	Pressure	1984/4/28	* P7
253	Well logging	Pressure test	LA-5	Pressure	1984/5/4	P8
254	Well logging	Pressure test	LA-5	Pressure	1984/1/5	P9
255	Well logging	Pressure test	LA-5	Pressure	1984/12/15	P10
256	Well logging	Pressure test	LA-5	Pressure	1984/12/18	P11
257	Well logging	Pressure test	LA-5	Pressure	1985/7/31	P12
258	Well logging	Pressure test	LA-5	Pressure	1985/9/8	P13
259	Well logging	Pressure test	LA-5	Pressure	1985/9/8	P14
260	Well logging	Pressure test	LA-5	Pressure	1984/3/16	Injection-Falloff
261	Well logging	Temperature logging	LA-6	Temperature	1984/7/4	T2
262	Well logging	Temperature logging	LA-6	Temperature	1984/7/5	T3
263	Well logging	Temperature logging	LA-6	Temperature	1984/7/7	T4
264	Well logging	Temperature logging	LA-6	Temperature	1984/7/10	T5
265	Well logging	Temperature logging	LA-6	Temperature	1984/7/12	T6
266	Well logging	Temperature logging	LA-6	Temperature	1984/7/17	T7
267	Well logging	Temperature logging	LA-6	Temperature	1984/7/22	T8
268	Well logging	Temperature logging	LA-6	Temperature	1984/7/24	T9
269	Well logging	Temperature logging	LA-6	Temperature	1984/8/3	T10
270	Well logging	Temperature logging	LA-6	Temperature	1984/8/31	T11
271	Well logging	Temperature logging	LA-6	Temperature	1984/9/6	T12
272	Well logging	Temperature logging	LA-6	Temperature	1984/11/1	T13
273	Well logging	Temperature logging	LA-6	Temperature	1984/11/5	T14
274	Well logging	Temperature logging	LA-6	Temperature	1984/11/27	T15
275	Well logging	Temperature logging	LA-6	Temperature	1985/2/8	T16
276	Well logging	Temperature logging	LA-6	Temperature	1985/2/9	T17
277	Well logging	Temperature logging	LA-6	Temperature	1985/6/12	T18
278	Well logging	WHP	LA-6	WHP	1984/11/4	WHP
279	Well logging	Pressure test	LA-6	Pressure	1984/7/3	P1
280	Well logging	Pressure test	LA-6	Pressure	1984/7/5	P4
281	Well logging	Pressure test	LA-6	Pressure	1984/7/7	P5
282	Well logging	Pressure test	LA-6	Pressure	1984/7/10	P6
283	Well logging	Pressure test	LA-6	Pressure	1984/7/12	P7
284	Well logging	Pressure test	LA-6	Pressure	1984/7/17	P8
285	Well logging	Pressure test	LA-6	Pressure	1984/7/21	P9
286	Well logging	Pressure test	LA-6	Pressure	1984/7/22	P10
287	Well logging	Pressure test	LA-6	Pressure	1984/7/24	P11
288	Well logging	Pressure test	LA-6	Pressure	1984/8/21	P12
289	Well logging	Pressure test	LA-6	Pressure	1984/9/3	P13
290	Well logging	Pressure test	LA-6	Pressure	1984/11/1	P14
291	Well logging	Pressure test	LA-6	Pressure	1984/11/4	P15
292	Well logging	Pressure test	LA-6	Pressure	1984/11/6	P16
293	Well logging	Pressure test	LA-6	Pressure	1984/11/26	P17
294	Well logging	Pressure test	LA-6	Pressure	1985/6/12	P18

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
295	Well logging	Pressure test	LA-6	Pressure	1987/12/31	P19
296	Well logging	Pressure test	LA-6	Pressure	1988/7/18	P20
297	Well logging	Pressure test	LA-6	Pressure	1989/12/30	P21A
298	Well logging	Pressure test	LA-6	Pressure	1989/12/31	P21B
299	Well logging	Pressure test	LA-6	Pressure	1990/8/1	P22
300	Well logging	Pressure test	LA-6	Pressure	1990/3/2	P24
301	Well logging	Pressure test	LA-6	Pressure	1990/6/2	P25
302	Well logging	Pressure test	LA-6	Pressure	1990/2/14	P26
303	Well logging	Temperature logging	LA-6	Temperature	2006/5/30	Kuster
304	Well logging	Pressure test	LA-6	Pressure	2006/5/30	Kuster
305	Well logging	Pressure test	LA-6	Pressure	1984/7/3	Injection-Falloff
306	Well logging	Temperature logging	LA-6	WPH	1984/11/27	Discharge Test
307	Well logging	Temperature logging	LA-6	Flow Rate	1984/11/27	Discharge Test
308	Well logging	Temperature logging	LA-6	Enthalpy	1984/11/27	Discharge Test
309	Well logging	Temperature logging	LA-7	Temperature	1984/10/18	T1
310	Well logging	Temperature logging	LA-7	Temperature	1984/10/19	T2
311	Well logging	Temperature logging	LA-7	Temperature	1984/10/24	T4
312	Well logging	Temperature logging	LA-7	Temperature	1984/10/25	T5
313	Well logging	Temperature logging	LA-7	Temperature	1984/10/28	T6
314	Well logging	Temperature logging	LA-7	Temperature	1984/10/29	T7
315	Well logging	Temperature logging	LA-7	Temperature	1984/11/16	T8
316	Well logging	Temperature logging	LA-7	Temperature	1984/11/17	T9
317	Well logging	Temperature logging	LA-7	Temperature	1984/11/19	T10
318	Well logging	Temperature logging	LA-7	Temperature	1984/11/19	T11
319	Well logging	Temperature logging	LA-7	Temperature	1984/11/23	T12
320	Well logging	Temperature logging	LA-7	Temperature	1984/11/23	T13
321	Well logging	Temperature logging	LA-7	Temperature	1984/11/24	T14
322	Well logging	Temperature logging	LA-7	Temperature	1984/12/3	T15
323	Well logging	Temperature logging	LA-7	Temperature	1984/12/4	T16
324	Well logging	Temperature logging	LA-7	Temperature	1984/12/10	T17A
325	Well logging	Temperature logging	LA-7	Temperature	1984/12/11	T17B
326	Well logging	Temperature logging	LA-7	Temperature	1984/12/12	T18
327	Well logging	Temperature logging	LA-7	Temperature	1984/12/26	T19
328	Well logging	Temperature logging	LA-7	Temperature	1985/1/1	T20
329	Well logging	Temperature logging	LA-7	Temperature	1985/1/23	T21
330	Well logging	Temperature logging	LA-7	Temperature	1985/1/26	T22
331	Well logging	Temperature logging	LA-7	Temperature	1985/4/25	T23
332	Well logging	Temperature logging	LA-7	Temperature	1985/4/27	T24
333	Well logging	Temperature logging	LA-7	Temperature	1985/4/29	T25
334	Well logging	Temperature logging	LA-7	Temperature	1985/5/27	T26
335	Well logging	Temperature logging	LA-7	Temperature	1985/5/30	T27
336	Well logging	Temperature logging	LA-7	Temperature	1985/9/21	T28
337	Well logging	Pressure test	LA-7	Pressure	1984/10/17	P1
338	Well logging	Pressure test	LA-7	Pressure	1984/10/24	P3
339	Well logging	Pressure test	LA-7	Pressure	1984/11/17	P4
340	Well logging	Pressure test	LA-7	Pressure	1984/11/25	P5
341	Well logging	Pressure test	LA-7	Pressure	1984/12/2	P6
342	Well logging	Pressure test	LA-7	Pressure	1984/12/25	P7
343	Well logging	Pressure test	LA-7	Pressure	1984/12/31	P8
344	Well logging	Pressure test	LA-7	Pressure	1985/12/1	P9
345	Well logging	Pressure test	LA-7	Pressure	1985/1/22	P10
346	Well logging	Pressure test	LA-7	Pressure	1985/4/26	P12
347	Well logging	Pressure test	LA-7	Pressure	1985/4/27	P13
348	Well logging	Pressure test	LA-7	Pressure	1985/5/20	P14
349	Well logging	Pressure test	LA-7	Pressure	1987/7/12	P15A
350	Well logging	Pressure test	LA-7	Pressure	1987/8/12	P15B
351	Well logging	Pressure test	LA-7	Pressure	1987/10/12	P15C
352	Well logging	Pressure test	LA-7	Pressure	1988/2/8	P16
353	Well logging	Temperature logging	LA-7	Temperature	2006/5/28	Kuster

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
354	Well logging	Pressure test	LA-7	Pressure	2006/5/28	Kuster
355	Well logging	Pressure test	LA-7	Pressure	1984/10/21	Injection-Falloff
356	Well logging	Temperature logging	LA-7	WPH	1985/7/18	Discharge Test
357	Well logging	Temperature logging	LA-7	Flow Rate	1985/7/18	Discharge Test
358	Well logging	Temperature logging	LA-7	Enthalpy	1985/7/18	Discharge Test
359	Well logging	Temperature logging	LA-8	Temperature	1984/12/16	T1
360	Well logging	Temperature logging	LA-8	Temperature	1985/3/11	T2
361	Well logging	Temperature logging	LA-8	Temperature	1985/3/14	T3
362	Well logging	Temperature logging	LA-8	Temperature	1985/3/15	T4
363	Well logging	Temperature logging	LA-8	Temperature	1985/3/19	T6
364	Well logging	Temperature logging	LA-8	Temperature	1985/3/21	T7
365	Well logging	Temperature logging	LA-8	Temperature	1985/3/25	T8
366	Well logging	Temperature logging	LA-8	Temperature	1985/5/5	T9
367	Well logging	Temperature logging	LA-8	Temperature	1985/5/13	T10
368	Well logging	Temperature logging	LA-8	Temperature	1985/9/9	T11
369	Well logging	WHP	LA-8	WHP	1985/4/2	WHP
370	Well logging	Pressure test	LA-8	Pressure	1984/5/12	P1
371	Well logging	Pressure test	LA-8	Pressure	1985/6/5	P3
372	Well logging	Pressure test	LA-8	Pressure	1986/3/28	P4
373	Well logging	Pressure test	LA-8	Pressure	1986/4/25	P5
374	Well logging	Pressure test	LA-8	Pressure	1987/12/15	P6
375	Well logging	Pressure test	LA-8	Pressure	1987/12/22	P7
376	Well logging	Pressure test	LA-8	Pressure	1988/7/23	P8
377	Well logging	Temperature logging	LA-8	Temperature	2006/5/28	Kuster
378	Well logging	Pressure test	LA-8	Pressure	2006/5/28	Kuster
379	Well logging	Pressure test	LA-8	Pressure	1985/3/13	Injection-Falloff
380	Well logging	Temperature logging	LA-8	WPH	1985/5/18	Discharge Test
381	Well logging	Temperature logging	LA-8	Flow Rate	1985/5/18	Discharge Test
382	Well logging	Temperature logging	LA-8	Enthalpy	1985/5/18	Discharge Test
385	Well logging	Temperature logging	LA-1	Temperature	1982/10/29	
386	Well logging	Temperature logging	TG-10	Temperature	1982/2/10	
387	Well logging	Temperature logging	TG-11	Temperature	1982/10/31	
388	Well logging	Temperature logging	TG-11	Temperature	1982/10/24	T1
389	Well logging	Temperature logging	TG-11	Temperature	1982/10/25	T2
390	Well logging	Temperature logging	TG-11	Temperature	1982/10/26	T3
391	Well logging	Temperature logging	TG-11	Temperature	1982/10/27	T4
392	Well logging	Temperature logging	TG-11	Temperature	1982/10/28	T5
393	Well logging	Temperature logging	TG-11	Temperature	1982/10/31	T6
394	Well logging	Temperature logging	TG-11	Temperature	1982/11/6	T7
395	Well logging	Temperature logging	TG-12	Temperature	1982/10/29	T1
396	Well logging	Temperature logging	TG-12	Temperature	1982/10/30	T2
397	Well logging	Temperature logging	TG-12	Temperature	1982/11/11	T3
398	Well logging	Temperature logging	TG-12	Temperature	1982/11/4	T4
399	Well logging	Temperature logging	TG-12	Temperature	1982/4/11	
400	Well logging	Temperature logging	TG-12A	Temperature	1982/10/29	T1A
401	Well logging	Temperature logging	TG-12A	Temperature	1982/10/30	T2A
402	Well logging	Temperature logging	TG-12A	Temperature	1982/11/1	T3A
403	Well logging	Temperature logging	TG-12A	Temperature	1982/11/4	T4A
404	Well logging	Temperature logging	TG-13	Temperature	1982/10/30	T1
405	Well logging	Temperature logging	TG-13	Temperature	1982/11/1	T2
406	Well logging	Temperature logging	TG-13	Temperature	1982/11/15	T3
407	Well logging	Temperature logging	TG-13	Temperature	1982/11/10	T4
408	Well logging	Temperature logging	TG-13	Temperature	1982/10/11	
409	Well logging	Temperature logging	TG-13A	Temperature	1982/11/1	T2A
410	Well logging	Temperature logging	TG-13A	Temperature	1982/11/5	T3A
411	Well logging	Temperature logging	TG-13A	Temperature	1982/11/10	T4A
412	Well logging	Temperature logging	TG-13A	Temperature	1982/10/30	T1A
413	Well logging	Temperature logging	TG-14	Temperature	1982/11/16	
414	Well logging	Temperature logging	TG-15	Temperature	1982/7/11	

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
415	Well logging	Temperature logging	TG-16	Temperature	1982/9/11	
416	Well logging	Temperature logging	TG-17	Temperature	1982/10/11	
417	Well logging	Temperature logging	TG-18	Temperature	1982/12/11	
418	Well logging	Temperature logging	TG-19	Temperature	1982/11/4	
419	Well logging	Temperature logging	TG-2	Temperature	1982/10/28	
420	Well logging	Temperature logging	TG-20	Temperature	1982/11/15	
421	Well logging	Temperature logging	TG-21	Temperature	1982/11/16	
422	Well logging	Temperature logging	TG-22	Temperature	1982/11/17	
423	Well logging	Temperature logging	TG-23	Temperature	1982/11/17	
424	Well logging	Temperature logging	TG-24	Temperature	1982/11/18	
425	Well logging	Temperature logging	TG-25	Temperature	1982/11/18	
426	Well logging	Temperature logging	TG-3	Temperature	1982/11/25	
427	Well logging	Temperature logging	TG-4	Temperature	1982/6/2	
428	Well logging	Temperature logging	TG-5	Temperature	1982/6/8	
429	Well logging	Temperature logging	TG-6	Temperature	1982/12/2	
430	Well logging	Temperature logging	TG-7	Temperature	1982/5/25	
431	Well logging	Temperature logging	TG-8	Temperature	1982/11/11	
432	Well logging	Temperature logging	TG-11	Temperature	1982/10/29	
433	Well logging	Temperature logging	TG-12	Temperature	1982/2/10	
434	Well logging	Temperature logging	TG-13	Temperature	1982/10/31	
435	Well logging	Temperature logging	TG-14	Temperature	1982/10/24	
436	Well logging	Temperature logging	TG-15	Temperature	1982/10/25	
437	Well logging	Temperature logging	TG-16	Temperature	1982/10/26	
438	Well logging	Temperature logging	TG-17	Temperature	1982/10/27	
439	Well logging	Temperature logging	TG-18	Temperature	1982/10/28	
440	Well logging	Temperature logging	TG-19	Temperature	1982/10/31	
441	Well logging	Temperature logging	TG-20	Temperature	1982/11/6	
442	Well logging	Temperature logging	TG-21	Temperature	1982/10/29	
443	Well logging	Temperature logging	TG-22	Temperature	1982/10/30	
444	Well logging	Temperature logging	TG-23	Temperature	1982/11/11	
445	Well logging	Temperature logging	TG-24	Temperature	1982/11/4	
446	Well logging	Temperature logging	TG-25	Temperature	1982/4/11	
447	Well logging	Temperature logging	TG-11	Temperature	1982/10/29	T1
448	Well logging	Temperature logging	TG-11	Temperature	1982/10/30	T2
449	Well logging	Temperature logging	TG-11	Temperature	1982/11/1	T3
450	Well logging	Temperature logging	TG-11	Temperature	1982/11/4	T4
451	Well logging	Temperature logging	TG-11	Temperature	1982/10/30	T5
452	Well logging	Temperature logging	TG-11	Temperature	1982/11/1	T6
453	Well logging	Temperature logging	TG-11	Temperature	1982/11/15	T7
454	Well logging	Temperature logging	TG 2	Temperature	1982/11/10	
455	Well logging	Temperature logging	TG 3	Temperature	1982/10/11	
456	Well logging	Temperature logging	LA-1	Temperature	1982/11/1	
457	Well logging	Temperature logging	TG 4	Temperature	1982/11/5	
458	Well logging	Temperature logging	TG 5	Temperature	1982/11/10	
459	Well logging	Temperature logging	TG 6	Temperature	1982/10/30	
460	Well logging	Temperature logging	TG 7	Temperature	1982/11/16	
461	Well logging	Temperature logging	TG 8	Temperature	1982/7/11	
462	Well logging	Temperature logging	TG 10	Temperature	1982/9/11	
463	Well logging	Temperature logging	TG 12	Temperature	1982/10/11	T1
464	Well logging	Temperature logging	TG 12	Temperature	1982/12/11	T2
465	Well logging	Temperature logging	TG 12	Temperature	1982/11/4	T3
466	Well logging	Temperature logging	TG 12	Temperature	1982/10/28	T4
467	Well logging	Temperature logging	TG 12A	Temperature	1982/11/15	T1A
468	Well logging	Temperature logging	TG 12A	Temperature	1982/11/16	T2A
469	Well logging	Temperature logging	TG 12A	Temperature	1982/11/17	T3A
470	Well logging	Temperature logging	TG 12A	Temperature	1982/11/17	T4A
471	Well logging	Temperature logging	TG 13	Temperature	1982/11/18	T1
472	Well logging	Temperature logging	TG 13	Temperature	1982/11/18	T2
473	Well logging	Temperature logging	TG 13	Temperature	1982/11/25	T3

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
474	Well logging	Temperature logging	TG 13	Temperature	1982/6/2	T4
475	Well logging	Temperature logging	TG 13A	Temperature	1982/6/8	T1A
476	Well logging	Temperature logging	TG 13A	Temperature	1982/12/2	T2A
477	Well logging	Temperature logging	TG 13A	Temperature	1982/5/25	T3A
478	Well logging	Temperature logging	TG 13A	Temperature	1982/11/11	T4A

Well Logging Data in Tendaho area

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
1	Well logging	WHP	TD-1	Pressure	2002/2/19	
2	Well logging	Pressure test	TD-1	Pressure	1993/11/5	N.1
3	Well logging	Temperature logging	TD-1	Temperature	1993/11/5	N.1
4	Well logging	Temperature logging	TD-1	Temperature	1993/11/13	N.2
5	Well logging	Pressure test	TD-1	Pressure	1993/11/14	N.2
6	Well logging	Temperature logging	TD-1	Temperature	1993/11/14	N.3
7	Well logging	Pressure test	TD-1	Pressure	1993/11/16	N.3
8	Well logging	Temperature logging	TD-1	Temperature	1993/11/16	N.4
9	Well logging	Temperature logging	TD-1	Temperature	1993/11/17	N.5
10	Well logging	Pressure test	TD-1	Pressure	1993/11/23	N.4
11	Well logging	Temperature logging	TD-1	Temperature	1993/11/23	N.6
12	Well logging	Pressure test	TD-1	Pressure	1993/12/4	N.5
13	Well logging	Temperature logging	TD-1	Temperature	1993/12/4	N.7
14	Well logging	Pressure test	TD-1	Pressure	1993/12/9	N.6
15	Well logging	Temperature logging	TD-1	Temperature	1993/12/9	N.8
16	Well logging	Temperature logging	TD-1	Temperature	1993/12/9	N.9
17	Well logging	Pressure test	TD-1	Pressure	1993/12/18	N.7
18	Well logging	Temperature logging	TD-1	Temperature	1993/12/18	N.10
19	Well logging	Pressure test	TD-1	Pressure	1993/12/20	N.8
20	Well logging	Temperature logging	TD-1	Temperature	1993/12/20	N.11
21	Well logging	Pressure test	TD-1	Pressure	1993/12/25	N.9
22	Well logging	Pressure test	TD-1	Pressure	1993/12/28	N.10
23	Well logging	Pressure test	TD-1	Pressure	1994/1/1	N.11
24	Well logging	Temperature logging	TD-1	Temperature	1994/1/2	N.12
25	Well logging	Pressure test	TD-1	Pressure	1994/2/24	N.12
26	Well logging	Temperature logging	TD-1	Temperature	1994/1/10	N.13
27	Well logging	Pressure test	TD-1	Pressure	1994/2/27	N.13
28	Well logging	Temperature logging	TD-1	Temperature	1994/2/27	N.14
29	Well logging	Temperature logging	TD-1	Temperature	2007/4/4	
30	Well logging	Injection test	TD-1	Injection Rate	1993/11/16	N.1
31	Well logging	Injection test	TD-1	Pressure	1993/11/16	N.1
32	Well logging	Injection test	TD-1	Injection Rate	1993/12/11	N.2
33	Well logging	Injection test	TD-1	Injection Rate	1993/12/11	N.2
34	Well logging	Fall-off test	TD-1	Pressure	1950/1/1	
35	Well logging	Fall-off test	TD-1	delta P	1950/1/1	
36	Well logging	Fall-off test	TD-1	Pressure	1994/10/20	N.1
37	Well logging	Fall-off test	TD-1	delta P	1994/10/20	N.1
38	Well logging	Temperature logging	TD-1	Temperature	1993/11/6	N.1
39	Well logging	Temperature logging	TD-1	Temperature	1993/11/14	N.2
40	Well logging	Temperature logging	TD-1	Temperature	1993/11/23	N.3
41	Well logging	Temperature logging	TD-1	Temperature	1993/12/10	N.4
42	Well logging	WHP	TD-2	Pressure	2002/2/19	
43	Well logging	Pressure test	TD-2	Pressure	1994/5/25	N.1
44	Well logging	Temperature logging	TD-2	Temperature	1994/5/25	N.1
45	Well logging	Pressure test	TD-2	Pressure	1994/4/3	N.2
46	Well logging	Temperature logging	TD-2	Temperature	1994/4/3	N.2
47	Well logging	Pressure test	TD-2	Pressure	1994/4/18	N.3
48	Well logging	Temperature logging	TD-2	Temperature	1994/4/18	N.3
49	Well logging	Pressure test	TD-2	Pressure	1994/4/21	N.4
50	Well logging	Temperature logging	TD-2	Temperature	1994/4/24	N.6
51	Well logging	Temperature logging	TD-2	Temperature	1994/4/30	N.7
52	Well logging	Pressure test	TD-2	Pressure	1994/5/5	N.7
53	Well logging	Temperature logging	TD-2	Temperature	1994/5/5	N.8
54	Well logging	Pressure test	TD-2	Pressure	1994/5/19	N.8
55	Well logging	Temperature logging	TD-2	Temperature	1994/5/19	N.9
56	Well logging	Pressure test	TD-2	Pressure	1994/5/24	N.9
57	Well logging	Temperature logging	TD-2	Temperature	1994/5/24	N.1
58	Well logging	Temperature logging	TD-2	Temperature	1994/5/25	N.11

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
59	Well logging	Pressure test	TD-2	Pressure	1994/5/30	N.10
60	Well logging	Pressure test	TD-2	Pressure	1994/6/2	N.11
61	Well logging	Temperature logging	TD-2	Temperature	1994/6/2	N.13
62	Well logging	Pressure test	TD-2	Pressure	1994/9/25	N.12
63	Well logging	Temperature logging	TD-2	Temperature	1994/9/25	N.13
64	Well logging	Temperature logging	TD-2	Temperature	2005/4/19	
65	Well logging	Temperature logging	TD-2	Temperature	2007/3/24	
66	Well logging	Pressure test	TD-2	Pressure	2007/3/23	
67	Well logging	Discharge Test	TD-2	WHP	1994/5/16	
68	Well logging	Discharge Test	TD-2	WHT	1994/5/16	
69	Well logging	Discharge Test	TD-2	P lip	1994/5/16	
70	Well logging	Discharge Test	TD-2	hw	1994/5/16	
71	Well logging	Discharge Test	TD-2	WT	1994/5/16	
72	Well logging	Pressure test	TD-2	Pressure	1994/5/19	N.1
73	Well logging	Pressure test	TD-2	delta P	1994/5/19	N.1
74	Well logging	Temperature logging	TD-2	Temperature	1994/5/25	N.1
75	Well logging	Temperature logging	TD-2	Temperature	1994/4/7	N.2
76	Well logging	Pressure test	TD-2	Pressure	1994/5/26	N.2
77	Well logging	Pressure test	TD-2	delta P	1994/5/26	N.2
78	Well logging	Pressure test	TD-2	Pressure	1994/6/4	N.3
79	Well logging	Pressure test	TD-2	delta P	1994/6/4	N.3
80	Well logging	Pressure test	TD-2	Pressure	1994/6/11	N.4
81	Well logging	Pressure test	TD-2	delta P	1994/6/11	N.4
82	Well logging	Pressure test	TD-2	Pressure	1994/6/17	N.5
83	Well logging	Pressure test	TD-2	delta P	1994/6/17	N.5
84	Well logging	Pressure test	TD-2	Pressure	1994/6/30	N.5
85	Well logging	Pressure test	TD-2	delta P	1994/6/30	N.5
86	Well logging	Temperature logging	TD-3	Temperature	1994/9/13	N.1
87	Well logging	Temperature logging	TD-3	Temperature	1994/9/13	N.2
88	Well logging	Temperature logging	TD-3	Temperature	1994/9/15	N.3
89	Well logging	Pressure test	TD-3	Pressure	1994/9/21	N.2
90	Well logging	Temperature logging	TD-3	Temperature	1994/9/21	N.4
91	Well logging	Pressure test	TD-3	Pressure	1994/9/26	N.3
92	Well logging	Temperature logging	TD-3	Temperature	1994/9/26	N.5
93	Well logging	Pressure test	TD-3	Pressure	1994/9/30	N.5
94	Well logging	Temperature logging	TD-3	Temperature	1994/9/30	N.6
95	Well logging	Pressure test	TD-3	Pressure	1994/10/7	N.6
96	Well logging	Temperature logging	TD-3	Temperature	1994/10/7	N.7
97	Well logging	Pressure test	TD-3	Pressure	1994/10/10	N.7
98	Well logging	Temperature logging	TD-3	Temperature	1994/10/10	N.8
99	Well logging	Pressure test	TD-3	Pressure	1994/10/14	N.8
100	Well logging	Temperature logging	TD-3	Temperature	1994/10/14	N.9
101	Well logging	Pressure test	TD-3	Pressure	1994/10/15	
102	Well logging	Temperature logging	TD-3	Temperature	1994/10/15	N.10
103	Well logging	Pressure test	TD-3	Pressure	1994/10/20	N.9
104	Well logging	Temperature logging	TD-3	Temperature	1994/10/20	N.11
105	Well logging	Temperature logging	TD-3	Temperature	1994/10/21	N.12
106	Well logging	Pressure test	TD-3	Pressure	1994/10/25	N.10
107	Well logging	Temperature logging	TD-3	Temperature	1994/10/25	N.13
108	Well logging	Pressure test	TD-3	Pressure	1994/10/30	N.11
109	Well logging	Temperature logging	TD-3	Temperature	1994/10/30	N.14
110	Well logging	Temperature logging	TD-3	Temperature	1994/11/1	N.15
111	Well logging	Temperature logging	TD-3	Temperature	1994/10/10	N.6
112	Well logging	Injection test	TD-3	Injection Rate	1994/10/20	N.1
113	Well logging	Injection test	TD-3	Pressure	1994/10/20	N.1
114	Well logging	Temperature logging	TD-3	Temperature	1994/9/21	N.1
115	Well logging	Temperature logging	TD-3	Temperature	1994/9/26	N.2
116	Well logging	Temperature logging	TD-3	Temperature	1994/9/30	N.3
117	Well logging	Temperature logging	TD-3	Temperature	1994/10/10	N.4

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
118	Well logging	Temperature logging	TD-3	Temperature	1994/10/14	
119	Well logging	Temperature logging	TD-3	Temperature	1994/10/10	N.5
120	Well logging	WHP	TD-4	Pressure	2002/2/19	
121	Well logging	Pressure test	TD-4	Pressure	1994/5/3	N.1
122	Well logging	Temperature logging	TD-4	Temperature	1994/5/3	N.1
123	Well logging	Pressure test	TD-4	Pressure	1994/5/8	N.2
124	Well logging	Temperature logging	TD-4	Temperature	1994/5/8	N.2
125	Well logging	Temperature logging	TD-4	Temperature	1994/5/8	N.3
126	Well logging	Pressure test	TD-4	Pressure	1994/5/14	N.3
127	Well logging	Temperature logging	TD-4	Temperature	1994/5/14	N.4
128	Well logging	Pressure test	TD-4	Pressure	1994/5/18	N.4
129	Well logging	Temperature logging	TD-4	Temperature	1994/5/18	N.5
130	Well logging	Pressure test	TD-4	Pressure	1994/5/19	N.5
131	Well logging	Temperature logging	TD-4	Temperature	1994/5/19	N.6
132	Well logging	Pressure test	TD-4	Pressure	1995/5/27	N.6
133	Well logging	Temperature logging	TD-4	Temperature	1995/5/27	N.7
134	Well logging	Pressure test	TD-4	Pressure	1995/6/4	N.7
135	Well logging	Temperature logging	TD-4	Temperature	1995/6/4	N.8
136	Well logging	Pressure test	TD-4	Pressure	2005/3/1	N.11
137	Well logging	Temperature logging	TD-4	Temperature	2005/3/3	N.15
138	Well logging	Temperature logging	TD-4	Temperature	2005/3/20	N.14
139	Well logging	Pressure test	TD-4	Pressure	2006/1/31	N.12
140	Well logging	Pressure test	TD-4	Pressure	2006/2/1	N.13
141	Well logging	Temperature logging	TD-4	Temperature	2006/1/31	N.16
142	Well logging	Temperature logging	TD-4	Temperature	2007/3/20	N.17
143	Well logging	Pressure test	TD-4	Pressure	2007/3/19	N.14
144	Well logging	Pressure test	TD-4	Pressure	1995/5/18	
145	Well logging	Pressure test	TD-4	Pressure	1995/5/20	N.1
146	Well logging	Pressure test	TD-4	Pressure	1995/5/27	N.1
147	Well logging	Temperature logging	TD-4	Temperature	1995/5/18	
148	Well logging	Temperature logging	TD-4	Temperature	1995/5/20	
149	Well logging	Fall-off test	TD-4	Pressure	1995/5/12	N.1
150	Well logging	Fall-off test	TD-4	delta P	1995/5/12	N.1
151	Fall-off test	Discharge Test	TD-4	WHP	1995/5/14	
152	Fall-off test	Discharge Test	TD-4	WHT	1995/5/14	
153	Fall-off test	Discharge Test	TD-4	P lip	1995/5/14	
154	Fall-off test	Discharge Test	TD-4	hw	1995/5/14	
155	Fall-off test	Discharge Test	TD-4	WT	1995/5/14	
156	Well logging	Pressure test	TD-5	WHP	1995/5/14	
157	Well logging	WHP	TD-5	Pressure	2002/2/19	
158	Well logging	Temperature logging	TD-5	Temperature	2002/3/21	N.14
159	Well logging	Temperature logging	TD-5	Temperature	2002/3/22	N.15
160	Well logging	Temperature logging	TD-5	Temperature	2002/3/23	N.15
161	Well logging	Pressure test	TD-5	Pressure	2002/3/20	N.13
162	Well logging	Temperature logging	TD-5	Temperature	2002/3/19	N.16
163	Well logging	Pressure test	TD-5	Pressure	2002/3/19	N.14
164	Well logging	Pressure test	TD-5	Pressure	2002/3/22	N.15
165	Well logging	Temperature logging	TD-5	Temperature	2002/3/28	N.12
166	Well logging	Temperature logging	TD-5	Temperature	2002/4/22	N.18
167	Well logging	Temperature logging	TD-5	Temperature	2002/4/23	N.19
168	Well logging	Temperature logging	TD-5	Temperature	2002/4/5	N.20
169	Well logging	Pressure test	TD-5	Pressure	2002/4/5	N.16
170	Well logging	Pressure test	TD-5	Pressure	2004/4/21	
171	Well logging	Pressure test	TD-5	Pressure	2004/5/4	
172	Well logging	Pressure test	TD-5	Pressure	2004/5/12	
173	Well logging	Pressure test	TD-5	Pressure	2004/5/14	
174	Well logging	Pressure test	TD-5	Pressure	2005/3/7	
175	Well logging	Pressure test	TD-5	Pressure	2005/3/8	
176	Well logging	Pressure test	TD-5	Pressure	2005/3/9	

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
177	Well logging	Pressure test	TD-5	Pressure	2005/3/29	
178	Well logging	Pressure test	TD-5	Pressure	2005/3/9	
179	Well logging	Temperature logging	TD-5	Temperature	2005/3/8	
180	Well logging	Temperature logging	TD-5	Temperature	2005/3/29	
181	Well logging	Temperature logging	TD-5	Temperature	2005/4/11	
182	Well logging	Pressure test	TD-5	Pressure	2006/2/9	
183	Well logging	Pressure test	TD-5	Pressure	2006/3/6	
184	Well logging	Pressure test	TD-5	Pressure	2006/3/8	
185	Well logging	Pressure test	TD-5	Pressure	2006/3/8	
186	Well logging	Pressure test	TD-5	Pressure	2006/3/27	
187	Well logging	Temperature logging	TD-5	Temperature	2006/2/10	
188	Well logging	Temperature logging	TD-5	Temperature	2006/3/7	
189	Well logging	Temperature logging	TD-5	Temperature	2006/3/28	
190	Well logging	Pressure test	TD-5	Pressure	2007/4/2	
191	Well logging	Temperature logging	TD-5	Temperature	2007/4/2	
192	Well logging	production test	TD-5	Pwh	2003/3/25	
193	Well logging	production test	TD-5	Twh	2003/3/25	
194	Well logging	production test	TD-5	P lip	2003/3/25	
195	Well logging	production test	TD-5	Weir h.	2003/3/25	
196	Well logging	production test	TD-5	Mw	2003/3/25	
197	Well logging	production test	TD-5	Ms	2003/3/25	
198	Well logging	production test	TD-5	Mt	2003/3/25	
199	Well logging	production test	TD-5	H	2003/3/25	
200	Well logging	production test	TD-5	Qth	2003/3/25	
201	Well logging	Discharge Test	TD-5	Pwh	2003/3/25	
202	Well logging	Discharge Test	TD-5	P lip	2003/3/25	
203	Well logging	Discharge Test	TD-5	Weir h.	2003/3/25	
204	Well logging	WHP	TD-6	Pressure	2002/2/20	
205	Well logging	Temperature logging	TD-6	Temperature	2002/3/29	T10
206	Well logging	Temperature logging	TD-6	Temperature	2002/4/1	T11
207	Well logging	Pressure test	TD-6	Pressure	2002/3/27	P16
208	Well logging	Pressure test	TD-6	Pressure	2002/3/28	P16
209	Well logging	Pressure test	TD-6	Pressure	2002/3/30	P17
210	Well logging	Temperature logging	TD-6	Temperature	2003/3/28	T12
211	Well logging	Pressure test	TD-6	Pressure	2003/3/27	P18
212	Well logging	Pressure test	TD-6	Pressure	2003/3/29	P19
213	Well logging	Temperature logging	TD-6	Temperature	2004/3/30	T13
214	Well logging	Temperature logging	TD-6	Temperature	2004/4/1	T15
215	Well logging	Pressure test	TD-6	Pressure	2004/3/29	P20
216	Well logging	Pressure test	TD-6	Pressure	2004/4/3	P21
217	Well logging	Temperature logging	TD-6	Temperature	2005/2/24	N.16
218	Well logging	Pressure test	TD-6	Pressure	2005/2/26	P24
219	Well logging	Pressure test	TD-6	Pressure	2005/2/25	P23
220	Well logging	Pressure test	TD-6	Pressure	2005/2/24	P22
221	Well logging	Pressure test	TD-6	Pressure	2006/2/6	P25
222	Well logging	Pressure test	TD-6	Pressure	2006/2/7	P26
223	Well logging	Temperature logging	TD-6	Temperature	2006/2/2	N.17
224	Well logging	Temperature logging	TD-6	Temperature	2006/2/4	N.18
225	Well logging	Temperature logging	TD-6	Temperature	2007/3/27	N.18
226	Well logging	Pressure test	TD-6	Pressure	2007/3/28	P27
227	Well logging	Temperature logging	GBH-1	Temperature	1980/2/28	T4
228	Well logging	Temperature logging	GBH-2	Temperature	1980/4/29	T3
229	Well logging	Temperature logging	GBH-2	Temperature	1994/10/7	T4
230	Well logging	Temperature logging	GBH-3	Temperature	1980/4/29	T2
231	Well logging	Temperature logging	GBH-4	Temperature	1980/5/2	T1
232	Well logging	Temperature logging	GBH-5	Temperature	1980/5/1	T3
233	Well logging	Temperature logging	GBH-6	Temperature	1980/4/24	T4
234	Well logging	Temperature logging	GBH-6	Temperature	1994/7/7	T5
235	Well logging	Temperature logging	GBH-6	Temperature	1994/10/6	T6

S/N	Classification	Test Type	Location /Well ID	Measurement	Observation date	Remarks
236	Well logging	Temperature logging	GBH-7	Temperature	1980/4/26	T2
237	Well logging	Temperature logging	GBH-8	Temperature	1980/4/28	T1
238	Well logging	Temperature logging	GBH-8	Temperature	1994/10/8	T2
239	Well logging	Temperature logging	GBH-9	Temperature	1994/5/21	T1
240	Well logging	Temperature logging	GBH-9	Temperature	1994/5/25	T2
241	Well logging	Temperature logging	GBH-9	Temperature	1994/6/20	T3
242	Well logging	Temperature logging	GBH-9	Temperature	1994/5/24	T4
243	Well logging	Temperature logging	GBH-9	Temperature	1994/7/23	T5
244	Well logging	Temperature logging	GBH-9	Temperature	1994/10/13	T6
245	Well logging	Temperature logging	GBH-9	Temperature	1995/5/9	T7
246	Well logging	Temperature logging	GBH-9	Temperature	1995/5/23	T8

APPENDIX-8

MINUTES OF MEETING

THE PROJECT FOR FORMULATING MASTER PLAN ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA

MINUTES OF MEETING
BETWEEN
JOINT COORDINATION COMMITTEE
AND
THE JICA PROJECT TEAM
ON
THE INCEPTION REPORT
FOR
THE PROJECT FOR FORMULATING MASTER PLAN
ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA

The Project Team organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Mr. Shinya TAKAHASHI arrived the Federal Democratic Republic of Ethiopia (hereinafter referred to as "Ethiopia") on 13th October 2013 for the purpose of conducting the captioned project.

The Inception Report Meeting was held on 14th October 2013 at the head quarter of the Geological Survey of Ethiopia (hereinafter referred to as "GSE") with the participants listed in the attachment-1.

After the through discussions and follow-up meetings, the contents of the Inception Report was generally agreed as recorded in the Minutes of Meeting attached hereto.

Addis Ababa, 18th October 2013

Mr. Shinya TAKAHASHI	Mr. Masresha G. SELASSIE
Team Leader	Director General
JICA Project Team	Geological Survey of Ethiopia
Japan	Ethiopia

THE PROJECT FOR FORMULATING MASTER PLAN ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA
*** JICA Project Team ***
October 2013 – March 2015

RECORD OF DISCUSSION

ON

INCEPTION REPORT

FOR THE PROJECT FOR FORMULATING MASTER PLAN ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA

1. Selection of Target Area

<JICA Project team> We understand that ICEIDA's target sites and Reykjavik Geothermal (RG) concession sites are included in JICA's 16 target sites: however the Project Team intends to carry out the Master Plan for all the 16 sites as described in R/D. Therefore we would like to request GSE to coordinate with above organizations/agencies in order to avoid duplication/conflicts of surveys.

<GSE> We will coordinate with them in order to avoid duplication/conflicts. For the sites licensed to RG, we will confirm the license periods. If the licenses should still be effective, we will request RG that the Team shall conduct the survey in their fields.

<GSE> We would like to request the Team to include Corbetti geothermal sites to this M/P.

<JICA Project team> We think it is not suitable to include Corbetti geothermal site to the M/P for the following reasons:

- It is understood that RG holds the license of Corbetti site and plans to conduct test drilling within this year, and
- The objective of M/P is to prioritize all the geothermal sites to be newly developed; therefore it is not necessary to include the geothermal site where the development is ongoing.

<GSE> We understood.

<JICA Project team> The JICA Project Team will bring this issue back to Japan for the final approval by the JICA head office.

2. Accessibility of Target Area

<GSE> The following areas are not accessible by vehicle, very difficult even on foot; a helicopter would be necessary. We recommend the Project Team to conduct the survey with existing data/information of 1986 only.

- Damali (Damhali)
- Teo
- Danab

<JICA Project team> For the above-mentioned sites, it is also difficult for us to conduct that field survey in such sites due to security reasons. While we will review the existing data as thoroughly as possible, we would like to recommend GSE to conduct the field survey by the GSE-self for this M/P; otherwise GSE may miss a good opportunity to acquire the latest data of those sites.

<GSE> We will consider the survey in above sites. In case GSE conducts the survey, JICA shall assist in Logistics and equipment.

<JICA Project Team> We will discuss on Logistics with JICA. We will conduct a remote-sensing analysis for the all 16 sites before the next visit (January 2013); based on the results we will propose GSE the sites that are considered worth conducting site survey.

Further discussions were made between Mr. Solomon and Mr. Takahashi and the results of the discussion were as follows/

<GSE> If the above mentioned three sites should be excluded from the field survey due to the reason of difficult accessibility, GSE would like you to include two other sites, Fentale and Boseti in the Master plan.

<JICA Project Team> We will consider the possibility, in this case the three sites should be excluded from the prioritization analysis because the difficult accessibility may hinder the development, which will result in very low priority. We note that Fantale is located in Awash National park, we would like to discuss on this matter with JICA.

<GSE> GSE understood the case, but we still request you to evaluate the potential of the three sites with the existing information in any case remote sensing interpretation and rough estimation of potential shall be conducted on the bases of previous surveys and these areas shall be included in the maps to be produced for potential prospects in Ethiopia.

<JICA Project Team> We note that your requests will result in 18 sites for potential analysis, and 15 sites for prioritization analysis, and we agree in principle; subject to further discussion and approval of JICA head office.

<GSE> For the information to JICA Project team, GSE indicates that it is on grant negotiation to obtain partial funds from GRMF for detail surface exploration of one of the target areas (Dofan) to be conducted by GSE. If the grant finance is to be obtained it would be coordinated with JICA activity in this target area as input from GSE side.

<JICA Project Team> We understood and we will coordinate if the time schedule can be adjusted.

3. Laboratory Analysis by GSE

<GSE> While the technicians in the laboratory are well experienced and the results are accurate; some of reagents are not sufficient in stock. We would like to request the Team to procure necessary reagents for the Project.

<JICA Project team> Please inform us the type and quantity of reagents necessary. We will report to JICA head office for their consideration. If procurement should not be possible within the scope of the work of the Project, the samples that are not analyzed in GSE will be brought to Japan and/or South Africa to be analyzed.

4. Equipment for MT Survey

<JICA Project Team> For the MT/TEM survey to be conducted during the Project, we would like to request you to provide us with two teams to assist the Japanese consultants including the survey facilities for one each, total four (4) sets. (Two sets will be granted by JICA)

<GSE> We will provide the Team and staffs of GSE for the Project at GSE's expense. In addition, we would like to request the JICA Team to provide one analysis software of MT survey (WinGLink), in order to analyze MT data in the satellite office.

<JICA Project team> Please inform us of the details of the software. We will bring this issue back to Japan for JICA's approval.

<GSE> We will provide necessary information on it.

5. Analysis of Remote Sensing Data

<GSE> The analysis of remote sensing data is fundamental for us and we have a software for analysis. We would like to request the Project team to carry out On-The-Job training for analysis of target sites in Ethiopia as the part of technical transfer.

<JICA Project Team> Due to a constraint from the overall schedule, we will conduct that remote sensing analysis in Japan before the next visit. We are planning to explain the results to GSE at the initial period of the next visit; the explanation will include the methodology and interpretation as well. We do not assign a Japanese remote sensing expert, to Ethiopia. Instead, we will conduct a training for the analysis during the one month training period that is scheduled in June 2014 within the scope of this Project. Thus, we would like to request GSE to nominate one analysis expert for the one month training in Japan..

<GSE> Agreed.

6. Evaluation Criteria for Selection of Prioritized area

<GSE> Geothermal generation is considered as environmental-friendly generation. However, why are environmental/social considerations included as evaluation criteria?

<JICA Project team> Large-scale developments sometimes need resettlement of people, cause adverse impacts on ethnic minorities and so on in/around the project sites, which is an world-wide issues of interest. Therefore, careful approach of above issues should be a part of success of the Project. Furthermore, the project site shall be secured from security-related problems such as terrorism. Thus, the above-mentioned issues are indispensible for the criteria.

<GSE> We understood.

7. Reporting

<GSE> We understand the Interim Report (IT/R) will not be prepared by the Project Team.

However, as we think progress information to be shared within GSE, we would like to request you to prepare some documents for reporting the progress of the work at the end of the second site work in Ethiopia.

<JICA Project team> We think that much information will have not be accumulated by that time. Therefore, we would like to prepare a simple progress report that simply describes items that have been completed by that time and that will be conducted in the next steps, to share progress information.

<GSE> We would appreciate you to prepare such a short reports..

<GSE> In IC/R report, it is unclear that the soft copy of each report will be submitted or not. Please provide a soft copy of each report.

<JICA Project team> We will provide the soft copy on a CD-ROM or DVD for each report.

8. Undertakings by GSE

<JICA Project team> We would like you to conduct necessary arrangement for the following issues:

- Custom Clearance of survey equipment (e.g. sampling equipment) to be delivered to Ethiopia
- Custom Clearance for taking out of samples (e.g. rocks and water samples) to other countries
- Custom Clearance of Satellite Phones to be brought to Ethiopia
- Others necessary

<GSE> We will do our best to do so.

(End of Discussion)

THE PROJECT
FOR
FORMULATING MASTER PLAN ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA

Meeting on Discussion of IC/R

LIST OF ATTENDANCE

Date and time: 2:00PM 14th Oct Venue GSE Meeting Room

	Name	Position and Organization	E-mail Address	Mobile
1	Mascresha Gesesse	Director General		
2	Solomon Kebede	Geoth. director (GSE)		
3	Muluqeta Asaye	Geothermal Projects Manager EEPCO		
4	Hundie Melka	Chief Geologist, GSE		
5	Assefa Zerihun	Planning Director, GSE		
6	Temesgen Mesfin	Public Relation Head		
7	Ephrem Fufa	Program officer/JICA		
8	Yuichi Ichikawa	Representative, JICA Ethiopia		
9	Masahito Takeda	Geophysicist, SRED		
10	Tashiaki Hosoda	Deputy teamleader/Geology		
11	Naoki Kawahara	Electric Power Development / Database		
12	Shunyei TAKAHASHI	Team Leader Geothermal Development		
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THE PROJECT FOR FORMULATING MASTER PLAN

ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA

MINUTES OF MEETING
BETWEEN
JOINT COORDINATION COMMITTEE
AND
THE JICA PROJECT TEAM
ON
THE PROGRESS REPORT
FOR
THE PROJECT FOR FORMULATING MASTER PLAN
ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA

The Project Team organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Mr. TAKAHASHI Shinya arrived the Federal Democratic Republic of Ethiopia (hereinafter referred to as "Ethiopia") on 2nd April 2014 for the purpose of conducting the captioned project.

The Progress Report Meeting was held on 29th April 2014 at the head office of the Geological Survey of Ethiopia (hereinafter referred to as "GSE") with the participants listed in the attachment-1.

After the through discussions, the contents of the Progress Report were generally agreed as recorded in the Minutes of Meeting attached hereto.

Addis Ababa, 6th May, 2014

for 細田年晃

Mr. TAKAHASHI Shinya
Team Leader
JICA Project Team

THE PROJECT FOR FORMULATING MASTER PLAN ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA
*** JICA Project Team ***
October 2013 – March 2015

Hundie Melka
Chief Geologist

Mr. Hunde Melka
Chief Geologist
Geological Survey of Ethiopia

THE 2ND JOINT COORDINATION COMMITTEE

FOR

PROJECT FOR THE FORMULATING MASTER PLAN ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA

(PROGRESS REPORT)

DATE AND TIME: 29TH APRIL 2014 (TUE), 10:00-12:00
VENUE: CONFERENCE ROOM, GEOLOGICAL SURVEY OF ETHIOPIA (GSE)

LIST OF PARTICIPANT

Name	Position/ Organization	Signature
Yikeyis Eshetu	Ministry of Water, Irrigation & Energy	
Seblewongel Alemu	Drilling Service Directorate	
Alcalwoled Sefu	S. Reservoir Engineer	
Asfaw Teclu	Senior Geochemist	
Tesfaye Kassa	Senior Geophysicist (Mineral Licensing and Administration)	
Solomon Kebede	Director, GSE (Geothermal dept)	
Manabu Momita	Project Manager of Aluto Langano Pj	
Mayumi Hayashi	JICA	
Yuichi Ichikawa	JICA Ethiopia	
Takasaburo Kimura	〃	
Daisuke Fukuda	JICA Study Team	Daisuke Fukuda
Toshiaki Hosoda	JICA Study Team	細田年昭
Shinya TAKAHASHI	〃	
Naoki KAWAHARA	JICA Study Team	
Shinsuke Sato	JICA Study Team	
Tsukasa Yoshimura	〃	
Mulugeta Asaye	EEP, Geothermal Proj. Manager	
Yoshihisa Shiraishi	Embassy of Japan	
Salahadin Ali	GSE (Geothermal)	
Habte Berhanu	EEA	
Hundie Melka Asseta Zerihun	GSE GSE	

Name	Organization	Signature
Sahele Tamiru	Ministry of Water & Irrigation	
Betru Haile	& Energy M.O.M	

RECORD OF DISCUSSION
ON
THE PROGRESS REPORT
FOR
THE PROJECT FOR FORMULATING MASTER PLAN
ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA

Mr. Solomon Kebede, the Director of Geothermal Department, Geological Survey of Ethiopia opened the meeting on behalf of Mr. Hunde, the Chief Geologist of GSE, followed by self-introduction of each participant and the subsequent presentation by the Project Team.

The presentation was made in accordance with the program attached hereto; and the presentation materials are also attached.

After the presentation, discussions and questions were invited by Mr. Hunde; the following is a record of the discussions.

1. Ministry of Water, Irrigation and Energy (MoWIE) questioned how the rejection temperature of 150℃ was proposed; it might be too high. Mr. Yoshimura answered that The Project team assumed that the geothermal energy would be used for conventional steam turbines, and the temperature was taken from a results of a previous project.

2. GSE asked the Project team first, if the scope of the M/P includes drilling operations (of any kind) and second, how about the results of comparison of costs of hydro power and geothermal power.
   Mr. Takahashi answered to the first question that this M/P is not able to cover all the detailed investigations; the Project team conducted supplemental survey for geological and geochemical aspects as well as collecting existing information. Using this information, the Project team will carry out potential evaluation.
   Mr. Kawahara answered to the second question that this M/P will review the cost of hydropower by EEP, and geothermal from a case of Aluto-Langano concerning some case in other countries.
   Mr. Yoshimura added that the installation cost of geothermal plant is higher than that of hydropower, but utilization rate of geothermal plant is much higher than that of hydropower, so running cost of geothermal plant is cheaper in many cases. It depends on the site conditions.

3. MoWIE mentioned that the Ethiopian government presently proceeds with hydropower development aiming at an electric energy supply of 80,000 GWh by the year of 2025, but that even if all the planned projects will be completed, the hydropower will cover only one third of the total demands expected, therefore, geothermal energy will definitely be necessary as second base load energy. In this M/P, the aim is 5,000 MW, but the aim is not limited.

4. MoWIE intends that the Project team will offer estimations of geothermal resource potential that is useful for their strategy of development.
   Mr. Takahashi answered that MW for each prospect would be estimated though the limited information.
   GSE proposed to share the data to be input to this M/P between MoWE and the Project Team, and it was agreed.

5. GSE questioned on the progress of the survey on direct use of geothermal.
   Mr. Takahashi answered that the Project team is now getting information and experience of direct use, and intends to propose direct use that is socially/ economically suitable for a region.

6. GSE questioned about MT survey; the Project team explained what the MT survey is and how the survey would be conducted.

Mr. Kimura, vice resident representative of JICA Ethiopia Office, expressed his appreciation for the cooperation to the Master plan project.

Mr. Shiraishi, Embassy of Japan, mentioned that the geothermal technology of Japan has well advanced and therefore GoJ would like to support Ethiopia in geothermal field.

Finally, Mr. Hunde thanked to all participants for their attendance and closed the meeting.

(End of Discussion)

MINUTES OF MEETING
OF
THE 4TH JOINT COORDINATION COMMITTEE
FOR
THE PROJECT FOR FORMULATING MASTER PLAN
ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA

The Project Team organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA"), headed by Mr. TAKAHASHI Shinya arrived the Federal Democratic Republic of Ethiopia (hereinafter referred to as "Ethiopia") on 3rd October 2014 for the purpose of conducting the captioned project.

The Joint Coordination Committee Meeting was held on 17th October 2014 at the head office of the Geological Survey of Ethiopia (hereinafter referred to as "GSE") with the participants listed in the attachment.

After the through discussions, the prioritization of target sites was generally agreed as recorded in the Record of Discussion attached hereto.

Addis Ababa, 20th October, 2014

Mr. TAKAHASHI Shinya
Team Leader
JICA Project Team

Hundie Melka
Chief Geologist

Mr. Hunde Melka
Chief Geologist
Geological Survey of Ethiopia

Mr. JIN Kimiaki
Chief Representative
JICA Ethiopia Office

JICA Japan International Cooperation Agency 1

The 4th Joint Coordination Committee Meeting

on

The Project for Formulating Master Plan on Development of Geothermal Energy in Ethiopia

Date and Time: 17th October 2014, 10:00 – 13:00

Venue: Conference Room, GSE Head office

Agenda

10:00-10:05	Opening Remarks by GSE
10:05-10:10	Introduction
10:10-10:40	Result of Field Survey at Dallol and Arabi
10:40-10:55	Result of Geological and Geochemical Analysis
10:55-11:20	Estimation of Geothermal Potential
11:20-11:30	<Tea Break>
11:30-11:45	Environmental Prioritization of Prospective Geothermal Energy Development Sites
11:45-12:05	Prioritization of Geothermal Power Plants
12:05-12:15	Institutional Issues
12:15-12:20	Direct use of Geothermal Resources
12:20-12:25	Way Forward of the Project
12:25-12:50	Discussion
12:50-12:55	Inviting Comments from JICA
12:55-13:00	Closing Address by GSE

** End of the Document **

THE 4TH JOINT COORDINATION COMMITTEE MEETING

FOR

THE PROJECT FOR FORMULATING MASTER PLAN ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA

DATE AND TIME: 17TH OCTOBER 2014 (FRI), 10:00-13:00

VENUE: CONFERENCE ROOM, GEOLOGICAL SURVEY OF ETHIOPIA (GSE)

LIST OF PARTICIPANT (1/2)

Name	Position/ Organization	Signature
Masresha G/Selassie	Director General	
Alejandro Moreno	International Finance Corp.	
P. VLAHAKIS	IFC	
Enatfenta Melaku	Director, Ministry of W&E	
Sisay Ayalew	Director, Ministry of Mines	
Tesfaye Kassa	Sen. Expert, Ministry of Mines	
[illegible]	[illegible]	
Solomon Ali	Senior geochemist	
Befekadu Oluma	Director, Geothermal	
Asfaw Gedlu	Senior Geochemist – Geothermal	
Bayu Wodaj	Drilling team leader	
Meway Abera	maintenance cordinator (Aluto)	
Mulugeta Asaye	GSDP project Manager	
Mesfin Tassew	Chief Op. Mgr (EEP)	
Tessema Gurgecha	EEP,	
Tsukasa Yoshimura	Nippon Koei (JICA Team)	
Shinsuke SATO	Nippon Koei (")	佐藤
Nobuhiro MORI	Nippon Koei (")	
Naoki Kawahara	Nippon Koei (")	
Daisuke Fukuda	Geothermal Engineering Co.Ltd.	福田大輔
Shinya TAKAHASHI	Team Leader of JICA Team	
Toshiaki Hosoda	JICA Project Team	細田年晃

RECORD OF DISCUSSION
ON
THE 4TH JOINT COORDINATION COMMITTEE
FOR
THE PROJECT FOR FORMULATING MASTER PLAN
ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA

Upon the opening of the Joint Coordination Committee (JCC) meeting, Mr. Masresia Gebreselasie, the Director General of Geological Survey of Ethiopia (GSE), delivered the opening address to all the participants therein, and Mr. Hundie, the Chief Geologist of GSE made his declaration with a welcoming address. Thereafter, Mr. Hundie, as the chairman of the meeting, invited the JICA Project Team for its presentations on the survey results achieved up to date.

The presentations were made in accordance with the program attached hereto; the presentation materials are also attached herewith.

After the presentations, the discussions and questions were invited by the chairman, Mr. Hundie; the following is the record of the discussions, with supplemental notes by the JICA Project Team.

1. Mr. Oluma, the Head of Geoscience Data Center of GSE, made various questions and comments, and the JICA Project Team responded as follows:

   (a) Mr. Oluma suggested that the existing gravity and infrared data of 1970s should be taken into account for reservoir estimation.
   Mr. Takahashi, the Team Leader of the JICA Project Team, replied him that the team considered as much information as possible, but some information might not come into the sights of the JICA Project Team. He requested Mr. Oluma to share information with the Project Team for the estimation.

   (b) Mr. Oluma asked why the survey was not conducted in Tulu Moye and Wondo Genet geothermal sites.
   Mr. Takahashi replied that the Project Team proposed GSE to excluded Tulu Moye from the field survey sites because the site is now under concession of a private firm, and that the proposal was accepted.
   Mr. Solomon, the Director of Geothermal Resource Assessment Directorate of GSE, explained that Wonde Genet was considered not having enough potential for power generation though the site has hot spring site; therefore the site was

excluded from the Master Plan Project.

(c) Mr. Oluma commented that the wide area of Aluto-1 (Aluto-Langano), Aluto-2 (Finkilo), and Aluto-3 (Bobessa) including the Oitu spring at Lake Langano should be considered to be one continuous body and be evaluated as a single geothermal reservoir.
Mr. Solomon explained that the target sites given to the JICA Project Team were defined by GSE; the three sites in the Aluto area under the question were separately defined as Aluto-1, Aluto-2 and Aluto-3.

(d) Mr. Oluma pointed out that the Project did not include the Lake Abhe site, though it is considered to be a good potential site.
Mr. Takahashi replied that the border zone of the neighboring countries is designated as a "keep-off zone" by the Government of Japan due to security reasons; therefore the Lake Abhe site was excluded from the Project.

(e) Mr. Oluma suggested that the permeability of reservoir rock and cap rock should also be reviewed with the previous results of Alto-Langano and Tendaho sites where test wells were provided.
Mr. Takahashi replied that the Project team reviewed the latest review results of both sites.

(f) Mr. Oluma commented that the priority has to be given to non-electrified rural areas such as Dallol where geothermal energy is available.
Mr. Takahashi replied that the concept of "local-production and local-consumption" would be an ideal development option, but this Master Plan has been programmed to work-out the development program that should be most beneficial to the country of Ethiopia as a whole. He also commented that rural electrification, though it should be also important, shall be considered separately.

(g) Mr. Oluma pointed out that the Dallol site is characterized by very high-salinity geothermal fluid like that of Djibouti, and that the Aluto-Langano experienced silica and carbonate scaling problems. He suggested that these should be considered in the Master Plan formulation.
Mr. Takahashi informed that in Djibouti, test wells are to be drilled at a different area from the area of high-salinity geothermal fluid instead of utilizing the fluid of high-salinity. That updated cost estimation has been available for Aluto-Langano and Tendaho. He also said that the JICA Master

Plan has taken into account those points as cost impacts.

2. Mr. Hundie of GSE and Ms. Enerhenta of Ministry of Mines (MoM) asked whether the Environmental and Social Considerations conducted by the JICA Master Plan Project is based on the IEE regulations of Ethiopia, and how the scoping were decided for the evaluation.
   Mr. Sato answered that the JICA Master Plan Project conducted the Environmental and Social Impact Assessment (ESIA) survey to collect information on socio/natural-environmental matters of all target sites; the information necessary for prioritization of geothermal sites. He added that this is not necessarily in compliance with the Ethiopian IEE regulations that has to be followed when a specific project is to be implemented, though the results of this study could be referred to, for the IEE or EIA; that if any projects indentified by this JICA Master Plan Projects to be implemented, the EIA followed by IEE for the identified has to be conducted in accordance with the Ethiopian regulations. The results of IEE obtained through the ESIA survey have been utilized limited to the prioritization or the rating of the prospective geothermal energy development sites in this Master Plan. Regarding the rating criteria, he explained that the Project Team applied appropriate rating hased on experiences together with local knowledge by the national consultant who conducted the survey.

3. Mr. Salahadin of GSE asked the reason why the project team used a quartz geothermometer for estimating reservoir temperature, instead other geochemical thermometers reported in previous reports.
   Mr. Fukuda, the Geochemist of the Project Team, answered that he had examined the results of various thermometers (quartz and alkaline thermometers) using the Project Team's and reference data. He observed that the quartz temperature indicated an almost uniform value for hot springs within each of the survey site, and a plausible temperature of the Aluto reservoir by the data of LA-8. With correction of a difference in the estimated temperature between the reservoir (LA-8) and neighboring hot springs (Oiutu), the use of a single geothermometer, as a standard procedure, is practically applicable to evaluate the entire survey sites.

4. Mr. Sahel of Ministry of Water, Irrigation and Energy (MoWIE) stated that the project period seemed to be too short for Aluto and Tendaho where the construction periods were announced as 2020 and 2021, respectively.
   Mr. Kawahara, the Electric development planer of the Project Team, responded to him that the periods for the Aluto-Langano and Tendaho project were quoted from

the existing documents, and an implementation period of six years is considered for the other sites.

Mr. Sahel mentioned that a period of six years seemed to be short as a project period of a green field for the construction of a geothermal power station.

Mr. Kawahara responded that the project team adopted the shortest period of time that can be achieved for the realization of a project.

5. Mr. Takahashi requested the participants for their comments on the proposal that some of geothermal development sites are prioritized over other renewable energy projects, i.e. solar and wind power, listed by the EEPCO master plan.

   Mr. Sahel of MOWIE responded that the first priority should be given to hydropower in Ethiopia at this moment, and that geothermal should be the next if it should be economically viable before the development of other renewable energy.

   Mr. Issa of World Bank commented that, the prioritization for development is based on the least cost approach, but should include the cost for transmission line.

   Mr. Takahashi replied that accessibility to the transmission line was considered in the prioritization as access road construction costs, and thereby the cost for transmission line is implicitly considered for the prioritization.

6. Through the discussions above, the contents of the presentation are generally accepted and appreciated by the participants.

Mr. Jin, the chief representative of JICA Ethiopia Office, commented that this master plan project was highlighted in the official Communiqué agreed upon by the prime ministers of Japan and Ethiopia, as one of the prioritized projects assisted by Japan, and that JICA intends to continue its support for the development of the geothermal energy in Ethiopia. He also commented that the proposal of "strategic enterprise" is a good idea to expedite the geothermal energy development in Ethiopia. As the closing of his comment, he expressed his appreciation to both GSE and the JICA Project team for the successful execution of this JICA Master Plan project up to date, and he requested the JICA project team that the JICA Master Plan project should be completed to the satisfaction to the both Governments of Japan and Ethiopia.

At the end of the JCC meeting, Mr. Hundie closed the meeting together with his thanks to all the participants for their attendance and various productive comments on the results of the JICA Master Plan Project.

(End of Document)

JICA Project Team

JICA TECHNICAL ASSISTANCE

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THE PROJECT FOR FORMULATING MASTER PLAN ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA

Date: 05 11 November, 2013

To: Geological Survey of Ethiopia

Your ref. Clarification on queries by JICA (October 24, 2013)

Our ref. JA12G1014-131105

Subject Target Sites for the JICA Master Plan Formulation Project

Dear Sir,

Having reviewed your letter addressed to Mr. Ichikawa, JICA Ethiopia office, MM and RD, with the concept of this Project in mind; our observations and recommendations are as follows:

Observations;

1. It is understood that the sixteen (16) sites agreed in MM and RD were the sites where various surveys including remote sensing analysis and site surveys were to be conducted; for the Master Plan formulation under this Project;
2. It is also understood that all recognized geothermal sites including such sites that are being developed, under preparation for development, green fields or etc should be included for the consideration under this Project, as this Project is to formulate the national geothermal development Master Plan that should consider an overall plan of geothermal power generation toward a target year. It is thus the Team agrees that the sites that GSE has recently proposed should be included in the Project;
3. We have also noted as a result of the first survey in Ethiopia, that the present conditions regarding geothermal development have changed from the time of MM/RD. We therefore reviewed them and prepared our recommendations for the necessary activates to be conducted by the Project;
4. Our recommendations together with the summary table are as follows.

Recommendations:

1. Prioritization will be examined with consideration of project development stages for the all the 22 sites as shown in the table;
2. Remote sensing analysis will be conducted for the 21 sites; and for the Corbetti site, the area will be analyzed where the satellite images already ordered for this project encompass;
3. Site survey will not be conducted in the following seven (7) sites; i.e. three (3) where a private firm has the concessions (Corbett, Abaya and Tulu Moya), and the three (3) where F/S has been or will have been completed (Aluto-langano-1, Tendaho-1 (Dubti), Tendaho-2 (Ayro Beda)), as well as one (1) site in a

National Park (Fantale). Analysis will be conducted of these sites with existing data to be made available to the Team.

4. As a result, site survey will be conducted in 15 sites (22 sites minus 7 sites); among those, GSE should undertake the survey in 6 sites where JICA Team is advised not to enter, as shown in the table;
5. MT/TEM survey will be conducted in two (2) sites to be selected from the 9 sites in the table below. Coordination will be made with a donor (ICEIDA/NDF) for the selection of the sites for TM/TEM survey to avoid duplication.

Summary of Target Sites

Geothermal Sites		Prioritization / Data base	Remote Sensing (within images already purchased)	Site Survey	Candidates for MT/TEM survey (2 sites from the below)
1	Dallol	☑	☑	GSE	-
2	Tendaho-3 (Allalo Beda)	☑	☑	☑	☑
3	Boina	☑	☑	GSE	-
4	Damali	☑	☑	GSE	-
5	Teo	☑	☑	GSE	-
6	Danab	☑	☑	GSE	-
7	Meteka	☑	☑	☑	☑
8	Arabi	☑	☑	GSE	-
9	Dofan	☑	☑	☑	☑
10	Kone	☑	☑	☑	☑
11	Nazareth	☑	☑	☑	☑
12	Gedemsa	☑	☑	☑	☑
13	Tulu Moya	☑	☑	-	-
14	Aluto-2 (Finkilo)	☑	☑	☑	☑
15	Aluto-3 (Bobesa)	☑	☑	☑	☑
16	Abaya	☑	☑	-	-
(17)	Fantale	☑	☑	-	-
(18)	Boseti	☑	☑	☑	☑
(19)	Corbetti	☑	▲	-	-
(20)	Aluto-1	☑	☑	-	-
(21)	Tendaho-1 (Dubti)	☑	☑	-	-
(22)	Tendaho-2 (Ayro Beda)	☑	☑	-	-

☑:Target for the M/P formulation project
▲:Analyses only for areas where the purchased satellite images encompass.
GSE: The sites where GSE should undertake the site survey.

Sincerely yours,

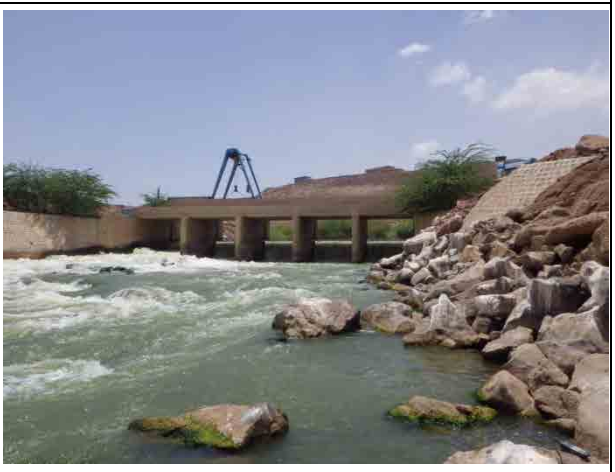
THE PROJECT FOR FORMULATING MASTER PLAN ON DEVELOPMENT OF GEOTHERMAL ENERGY IN ETHIOPIA
*** JICA Project Team ***
October 2013 – March 2015

TAKAHASHI Shinya
Team Leader
The Project for Formulating Master
Plan on Development of Geothermal Energy in Ethiopia
(JICA Assistance)

APPENDIX-9

RECORD PHOTOGRAPHS

No.2 AllaloBeda (Tendaho-2)

	
Overview	Hot spring and silica deposits beside the springs
	
Geysers and fumaroles from the ground; There are more than 20 geysers at the site.	Measuring the temperature of geyser
	
Fumalore from rocky slope.	Gate in Awash River for irrigation

No.7 Meteka (1/2)

Overview of site; the area is composed of swampy area (right) and fault scarp (right).

Awash River; the river is flown in the swampy area.

Meteka Spring; hot spring is welling from the foot of fault scarp.

Sampling of hot spring from the bath beside National Road

Sampling of hot spring at the roadside ditch

Termination of site survey due to bad road condition.

No.7 Meteka (2/2)

Sampling of hot spring beside Awash River

Outcrop at fault scarp; basaltic and andesitic rock is commonly observed.

Outcrop at fault scarp; clay veins with gypsum are observed.

Gypsum vain taken from the outclop

Termination of site survey due to bad road condition.

Dense bush with rocky ground in upland; it is difficult to conduct MT/TEM survey.

No.9 Dofan (1/2)

Termination of site survey due to bad road condition after heavy rain.

Overview of the Site

Dofan Basalt; Basalt lava is observed on the way to manifestation area.

Large hot spring; plenty amount of water is flown out.

Measuring temperature at hot spring

Measuring temperature of fumarole used for bathing

No.9 Dofan (2/2)

Fumaroles in basalt lava; white clay and sulfur are observed at the fumaroles.

Altered basalt/ Trachytic andesite; white clay and sulfur are common.

Yellow sulfur vain is developed in white clay zone.

Measuring ground temperature

Crystallized sulfur; local peoples are mining and extracting sulfur for selling.

Extracted sulfur by local miner for selling

No.10 Kone (1/2)

Overview of Korke Caldera; East of Kone Caldera, Surrounded by caldera scarp.

Korke Caldera; filled by basalt lava.

Geological survey at the north of Kone Caldera

Obsidian pyroclastic rock was found at the north of Kone Caldera

Western Rim of Kone Caldera

Very recent basalt lava is erupted in Kone Caldera

No.10 Kone (2/2)

Overview of Kone Caldera; dense bush is grown and difficult to walk through.

Entering Kone Caldera; footpath is only available and vehicle cannot enter inside.

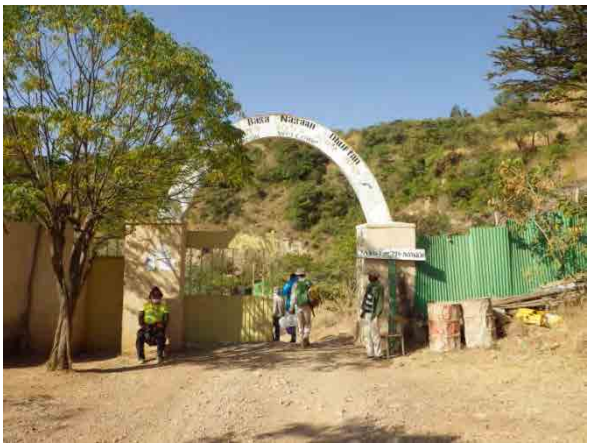
Ropy wrinkles of basalt lava (Pahoehoe lava)

Basalt lava cave

Small crater of basalt lava

Fumalore from basalt lava (Gur Fumarole)

No.11 Nazreth (1/2)



Entrance of Boko Sanatorium; fumaroles are used for medicine

Fumaroles are observed at the front cliff; Wonji Fault scarp.

Steam bath house constructed closer to the cliff.

Fumarole is found at the fracture in the cliff; local peoples put bottles to collect water.

Gas sampling from the fracture

Amorphous quartz (agate) sub-originated at the cliff.

No.11 Nazreth (2/2)

Entrance of Sodole Hot Spring; pools, baths and cottages are constructed for customers.

One of the source of Sodole hot springs

Geochemical survey of Sodole hot springs

Awash River flown beside Sodole hot springs

Another source of Sodole hot springs; algae is grown in the spring,

Sampling at another source of Sodole hot springs

No.12 Gedemsa (1/2)

	
Asking the way to local peoples	Going to climb up caldera wall
	
Inside the caldera from caldera wall	Amorphous Quartz (agate) was found in acidic welded tuff layer, outcropped at caldera wall.
	
Seeing south caldera wall	Seeing east caldera wall and Lake Koka

No.12 Gedemsa (2/2)

	
Warm water from the borehole at the south of Gedemsa Caldera	Fumarole at the south of Gedemsa Caldera; local peoples dig the cave (left) for bathing.
	
Basalt lava observed at the south of Gedemsa Caldera (front)	Hot spring in Gergedi (Hippo Pool); located beside Awash River
	
Bathing facility	Source of Hot Spring; the Spring is located on Wonji Fault.

No.14 Finkilo (1/2)

	
Overview; the site is composed of slopes and terraces.	Pumice tuff is commonly observed at the surface.
	
Deep valley in the site; many fumaroles are observed.	Fumaroles in dense bush
	
Shore of Lake Langano; many hot springs are observed.	Hot spring at the shore of Lake Langano; Local peoples are used for bathing.

No.15 Finkilo (2/2)

	
Overview of Finkilo; thick pumice tuff layer covered the surface.	Closer view of pumice tuff layer; sedimentation shows pumice fall deposit.
	
Fumaroles at the slope (center)	Altered reddish clay observed at the fumaroles area.
	
Viewing the north of Aluto Volcanic Complex	Thermal Gradient Well (TG Well) found at the foot of Finkilo site

No.15 Bobesa (1/2)

	
Overview of Bobesa; many fumaroles are found.	Closer view of Bobesa; fumaroles are spouted out from fractures.
	
Closer view of fumaroles; color of rock is changed into reddish.	Closer view of fumaroles; many fumaroles are spurted out with sounds.
	
Sampling of gas from fumaroles	Stratified volcanic tuff observed on the way to the site

No.15 Bobesa (2/2)

Small fumaroles from fracture in outcrop

Fumaroles in Gebiba, approx 9km SSW from Bobesa, outside of Aluto Volcano

Water collecting by local peoples in Gebiba; They put grass to cool down the steams.

Altered reddish clay observed at around fumaroles area.

Welded tuff in Gebiba

Trachytic Andesite lava at Gebiba, covered by welded tuff

No.18 Boseti (1/2)

Site investigation of fumaroles (Steam bath) in Kintano; fumaroles is from fracture of basalt lava.

White pumice tuff is observed at some part of the ground.

Fault scarp (right) with open crack in Kintano; fumaroles are observed along the faultline.

Fault scarp (right) and obsidian lava (left)

Measuring temperature of fumarole

Gas sampling from fumarole

No.18 Boseti (2/2)

Overview of MT/TEM Site and Boseti Bericha mountain (left); The area covered by Obsidian lava.

An end of obsidian lava flow.

Obsidian lava block; lava looks viscous and flow structure is developed.

Topographic survey for MT survey

Setting of electrode below the ground

Moving to the next measurement point

No.20 Aluto-1 (Aluto-Langano)

Drilling rig at LA-9D test well site

Geothermal well and separator in LA-4

Gas sampling in LA-6

Setting sampling ornament at LA-8

Turbine and Generator in Aluto-Langano Geothermal Power Plant

Operation room in Aluto-Langano Geothermal Power Plant

No.21 Dubti (1/2)

Well head of TD-1

Well head of TD-1 (BOP)

Hot spring in Dubti; the hot water contains mud and bubbles.

Mud pool in Dubti

Small Fumarole in Dubti

The color of sample shows Containing of Sulfur in collected gas

No.21 Dubti (2/2)

Well head of TD-6; BOP is tilting.

Opening the valve of TD-6

Overview of TD-4 Test well

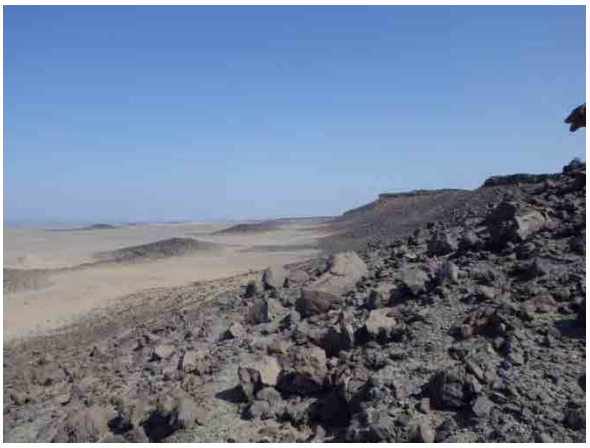
TD-4 Test well; mud is frown out beside the well.

Well head of TD-5

Silencer of TD-5

No.22 Ayrobera (1/2)

Overview of Ayrobera Site; Fumaroles are at the mounds in Alluvial Plain.



A Major Fault scarp; which runs through the direction of NW-SE.

Wet ground due to fumaroles

Wet ground due to fumaroles; many wet grounds are observed.

Measuring the temperature of fumarole from the ground

Gas Sampling of the fumaroles from the ground

No.22 Ayrobera (2/2)

Gypsum (White stone) and Gas Samples

Setting of Induction Coil for MT Survey

Completion of MT Survey Setting

Setting of Inductor Coil for TEM Survey

Topographic Survey and Setting of TEM Survey Equipment

TEM Survey Measurement

Additional Site Survey: Seha, North of Tendaho (1/2)

	
Overview; Surface is covered by basalt lava.	Collapsed basalt lava cave; weak fumaroles was found from the cave.
	
Steep and sharp fault; the trend is NW-SE, concordant with Manda- Harraro Graven.	Top view from fault scarp; water is spouted out from the foot of the fault.
	
View along the fault scarp; water is spouted out from the foot of the fault.	Sampling of water in hot spring located at the foot of the fault scarp.

Additional Site Survey: Lake Loma, North of Tendaho (2/2)

	
Fault scarps and Alluvial plain	Basalt lava is observed at fault scarp
	
Caldera lake (Lake Loma)	Water Sampling at Crater lake; water is cold.
	
Climbing up the caldera wall	Recent basalt lava flow

Additional Site Survey: Butajira

Crater Lake in the south of Butajira (Lake Ar Shetan)

Butajira Geothermal Site; hot water was splashed out at the depth of approx. 200m when water well was drilled.

Water well drilling point; small pond was performed.

Butajira hot spring; hot spring is located at low land of the area.

Butajira hot spring; local peoples are fetching water and cooking maize.