インドネシア共和国
ニッケルラテライト鉱処理技術協力事業
事前調査団報告書

昭和61(1986)年3月

国際協力事業団

はじめに

インドネシア共和国は、ニッケル鉱の埋蔵鉱量で世界第3位にランクされるほどの資源保有国であるにもかかわらず，国内での金属ニッケルの製錬量が乏しく、国内需要は輸入に依存している。このためインドネシアは、未利用のまま放置されている低品位ニッケル鉱の処理技術を確立し、当国の経済発展に寄与するため我が国に対して技術協力を要請してきた（公電：昭和58年9月8日第1205号、昭和59年6月22日第911号）。我が国はこれを受け、昭和59年度の日イ年次協議において、事前調査案件として取りあげるべく検討する旨を表明した。

インドネシア側の要請内容は、低品位ニッケル鉱の鉱物学的諸特性の調査、試験、並びに冶金学的実験からパイロットプラントによる試験まで広範囲にわたっているため、その要請背景、協力の必要性などについて詳細に把握し、また我が国が実施するプロジェクト方式技術協力のシステムを充分に説明するなど双方の意見調整と協議を行なうことを主目的として、今回の事前調査団が派遣されたものである。

本報告書は、この事前調査団の調査結果をとりまとめたものである。

ここに、本調査団派遣に際し御協力を頂いた関係各位に対し、深甚なる謝意を表する次第である。

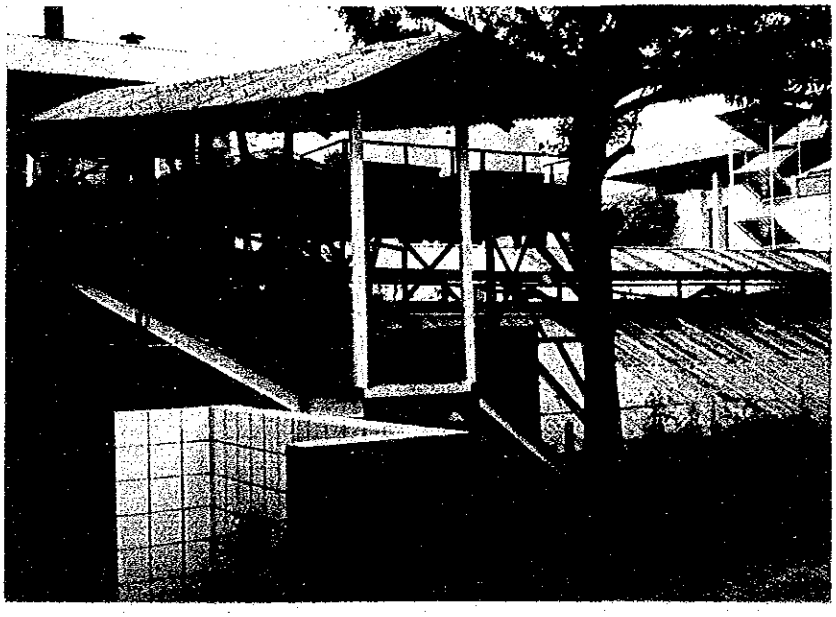
昭和61年3月

鉱工業開発協力部長

北村俊男

冨田団長(右)と国家科学技術院(LIPI)長官による議事録署名交換
——ジャカルタ——

国立冶金研究所(LMN)
研究講義棟
(前列左から)
光富専門家，冨田団長，
伊奈団員
(後列左から)
甲谷団員，仁田団員，
佐藤団員　　——バンドン——



国立冶金研究所(LMN)
敷地内にある溶鉱炉パイロットプラント　——バンドン——

目　　次

Ⅰ　事前調査団の派遣

１１　調査団派遣の経緯と目的

インドネシアのニッケル鉱は全量ニッケルラテライト鉱で、埋蔵鉱量は世界第３位にランクされるほど豊富である。これらニッケルラテライト鉱の中でも、品位の高いものは全量輸出に向けられており、また低品位のものは処理技術水準の低さから未利用のまま放置されているのが現状である。他方、「イ」国は豊富なニッケル資源の保有国であるにもかかわらず、国内での金属ニッケル生産を行なっていないため、国内需要に対しては安価な外国産の金属ニッケルを輸入して供給にあてており、輸入量は年々増加傾向にある。

このような状況から、「イ」国では今後も増加が見込まれるニッケルの国内需要に対して、未利用のまま放置されている低品位鉱を処理して金属ニッケルを生産する技術の開発が国家的課題として挙げられており、低品位ニッケルラテライト鉱の鉱床学的諸特性の調査・冶金学的処理から中間処理プラントの建設にいたる一貫した技術協力を我が国に要請越した。これに対し我が方は、昭和５２年から単独専門家派遣によって協力を行なってきたが、今般、実験室レベルの研究から将来の商業化を目指す技術開発へとスケールアップすることを目的に、プロジェクト方式技術協力を要請越したものである。

こうした背景をもとに、今回の事前調査団派遣により、「イ」側の要請内容、協力の必要性などについて詳細に調査し、また我が国が実施するプロジェクト方式技術協力のしくみを充分に説明するなど双方の意見調整と協議を行なうこととなった。

１２　調査団々員の構成

	担当分野	氏　名	現　職
団　長	総　括	富田堅二	国際協力事業団専門技術嘱託
団　員	技術協力計画	佐藤良夫	通商産業省基礎産業局非鉄金属課
団　員	製錬（乾式）	甲谷　裕	住友金属鉱山株式会社エンジニアリング本部エンジニアリング部参事
団　員	製錬（湿式）	伊奈勝利	住友金属鉱山株式会社エンジニアリング本部エンジニアリング部副課長
団　員	業務調整	仁田知樹	国際協力事業団鉱工業開発協力部鉱山工業開発技術課

13 調査日程

日順	月日	曜	AM/PM	調査内容	宿泊地
1	3/21	金	AM	・成田発（JL 721）	
			PM	・ジャカルタ着	
				・JICA青木職員と打合せ	ジャカルタ
2	22	土	AM	・JICA遠藤所長、青木職員、光富専門家へ対処方針等説明・協議並びに日程打合せ	
				・日本大使館福島二等書記官へ対処方針等説明	
			PM	・LIPI（国家科学技術院）と第1回協議（於LIPI本部）	ジャカルタ
3	23	日	AM	・ジャカルタ発（乗用車）	
			PM	・バンドン着	
				・光富専門家と詳細打合せ	バンドン
4	24	月	AM	・LMN（国立冶金研究所）と第1回協議（於LMN）	
			PM	・LMN（ 〃 ）と第2回協議（ 〃 ）	
				・LIPI（国家科学技術院）と第2回協議（ 〃 ）	
				・団員打合せ（M/M原案作成）	バンドン
5	25	火	AM	・LMN（国立冶金研究所）所内視察	
				・LMN（ 〃 ）と第3回協議（於LMN）	
			PM	・LMN（ 〃 ）と第4回協議（ 〃 ）	バンドン
6	26	水	AM	・LMN（国立冶金研究所）と第5回協議（於LMN）	
			PM	・バンドン発（乗用車）	
				・ジャカルタ着	ジャカルタ
7	27	木	AM	・CABINET SECRETARIAT 担当課長と面談	
				・ANEKA TAMBAN 社長と面談	
			PM	・PUSPIPTEK（スルポン）視察	ジャカルタ
8	28	金	AM	・資料整理	
			PM	・ 〃	ジャカルタ
9	29	土	AM	・LIPI（国家科学技術院）と第3回協議（於LIPI本部）M/M署名交換	
				・JICA遠藤所長、榎本次長へ報告	
			PM	・帰国準備	
				・ジャカルタ発（JL 722）	機中
10	30	日	AM	・成田着	

14 主要面談者

(1) インドネシア側

1) Indonesian Institute of Science (LIPI)

Prof. Dr. D.A.Tisna Amidjaja, Chairman

Prof. Didin Sastrapradja, Vice Chairman

Ir. S.Kayatmo, Deputy Chairman for Technical Sciences

Dr. Apilani Sugiarto, Deputy Chairman for Natural Sciences

Prof. Dr.Muhammadi, Assistant for International Cooperation

Miss Moertini Atmowidjojo, Head of International Relation Bureau

2) National Institute for Metallurgy (LMN)

Dr. Djoewito Atmowidjojo, Director

Ir. Sukarna Djaya, Assistant Director for Research

Ir. A. Sulaiman, Assistant Director for Development

Mr. Redjadi Kodijat, Secretary

Ir. Yusuf, Head of Extractive Metallurgy Division

Ir. Wahyudin, Head of Metals Technology Division

Ir. Eddy Dwi Tjahjono, Extractive Metallurgy Division

3) Cabinet Secretariat of the Republic of Indonesia

Mr. Wahid Salim, Heaf of Intergovernmental Technical Cooperation Division, Bureau for Technical Cooperation

4) The National Center for Research, Science and Technology Project (PUSPIPTEK)

Ir. Gunawan Sakri Soemargono, Director of Planning, Office of the Minister of State for Research and Technology

5) ANEKA TAMBANG

Ir. Kosim Gandataruna, President

(2) 日　本　側

1) 在インドネシア日本国大使館

二等書記官	福　島　　章

2) ＪＩＣＡジャカルタ事務所

所　　長	遠　藤　英　夫
次　　長	榎　本　正　義
職　　員	青　木　澄　夫

3) ＪＩＣＡ派遣専門家

（派遣先：ＬＭＮ）	光　富　勝　義

Ⅱ 要　　約

本件事前調査団派遣の目的は、すでに前章で述べたように、インドネシア側に対し、プロジェクトタイプ技術協力のシステムを説明し、理解を得るとともに、我が方としては、要請の背景と内容を具体的に調査し、技術協力へ向けての方途を調整するということであったが、その概要は以下のとおりである。

(1) イ側は、本件技術協力の目的は、インドネシア産低品位ラテライト鉱の処理に必要なエンジニアリングデータと経済評価に必要なデータの取得にあることを明らかにした。

(2) 従って、過去4年間にわたるＪＩＣＡからの個別派遣専門家による協力の成果を基盤として、パイロットプラントでの連続試験により、前項で述べたようなデータの取得を行ない、工業化へ向けて対処したいとしている。

(3) これに対し、調査団からは、本件プロジェクトの工業化には、特にエネルギー消費量の低減と収率の向上が重要であることを指摘し、その共通認識の下に、ＳＭＭ法について討議が行なわれ、最終的にその導入にイ側は理解を示した。

(4) 以後、イ側からは、専門家派遣、研修員受入れ、機材供与等について要請内容の説明があり、また、カウンターパート及びローカルコストの確保については、重要性認識の表明があり、これらの概要は議事録（Ｍ／Ｍ）としてまとめられた。

(5) 本件プロジェクトの実施スケジュールに関しては、イ側から当初2年間は実験室規模の協力をバンドンで、以後3年間はパイロットプラント規模での協力をスルボンで行なわれたい旨の意図表明があった。

(6) これに対し、調査団からは、協力の第3年目にパイロットプラントを収容する建屋がイ側によってスルボンに建設される見通しが不明である点を指摘し、その解決に努力されたい旨を強調した。

(7) このような状況は、原油価格の下落等によるインドネシア経済の不況に原因するところが大きいとはいえ、本件プロジェクトの推進に際して、最大の問題点となることが明らかになった。

(8) 最終的に、本件プロジェクトの背景、必要性、具体的内容等については相当部分が明確にされたが、プロジェクトのサイトについては今後の進展に委ねられることになり、未解決のまま残されたことになる。

(9) 結論として、本調査団としては、本件プロジェクトへの技術協力の妥当性については理解が得られたものの、プロジェクトの実施へ向けてはプロジェクトサイトへの判断が前提条件になるということである。

Ⅲ　要請の背景

インドネシアは豊富な天然資源を保有しているが、その中でも鉱物資源は当国の経済発展にとって、重要な地位を占めている。（１９８４年度予算では外国援助を除く国家収入の約６７％となっている。）

ニッケルラテライトはインドネシアの鉱物資源のなかでも、最も重要な戦略資源の１つになっている。ニッケル資源の埋蔵量は世界第３位と称せられ、１９７６年のデータではニッケル含有量1,４００万ｔと推定されている。

しかしながら現在のところ、このニッケル資源の利用は1.8％Ni以上のラテライトに限られており、2.5％Ni以上の高品位ラテライトはニッケル鉱石として、1.8～2.5 Niの中品位ラテライトはフェロニッケル、ニッケルマットとして、それぞれ輸出され、貴重な外資獲得源（1.4億ドル－１９８４年）となっているが、低品位部分のラテライトは未利用のまま放置されている。

この低品位ニッケルラテライト鉱の利用については、多年にわたって、研究・開発が行なわれているが、最近は特に金属価格の低迷とラテライトの処理に要するエネルギーコストの増大などの理由で停滞しているのが現状である。

このような情勢の下で、インドネシア側は戦前・戦中・戦後を通じ、当国ニッケルラテライト資源の開発利用に寄与してきた我が国のニッケルラテライト鉱処理技術に注目し、その技術移転を希望していることが、本件プロジェクトの要請の背景となっている。

Ⅳ 協 議 の 概 要

4.1 プロジェクトの名称

本件プロジェクトの名称については、下記のとおりとすることで、双方の意見が一致した。

"RESEARCH AND DEVELOPMENT OF INDONESIAN LOW GRADE NICKEL LATERITES"

4.2 プロジェクトの実施機関

インドネシア側のプロジェクト実施機関は下記のとおりであることを確認した。

"NATIONAL INSTITUTE FOR METALLURGY, INDONESIAN INSTITUTE OF SCIENCES (LMN, LIPI)"

4.3 プロジェクトの期間

本件プロジェクトの日本側による協力期間は、R/D調印ののち5年間とすることで双方の意見が一致した。なお、インドネシア側は昭和61年度におけるR/D調印を希望している。

4.4 プロジェクトの実施場所

インドネシア側の説明によると、本件プロジェクトの実施機関であるLMNは、ジャカルタ郊外のスルポン(SERPONG)に建設されつつある研究科学技術センター(PUSPIPTEK)へ移転することが、すでに正式に決定されていたが、たまたま最近の原油価格の暴落、一次産品の不況等々の経済情勢の低迷のため、移転計画の実施は全て中断されているとのことである。

このため、本件プロジェクトは、当初、スルポンにパイロットプラント棟を含めて、必要な施設をインドネシア側が建設することとしていたが、実施不可能となったため、下記のような代替案を提案してきた。

(1) 当初2年間はバンドンで実施する。

(2) 以後、パイロットプラントの建屋と関連施設が利用できる状況となった時、本件に関係する全スタッフと機器をスルポンへ移転させる。

(3) 但し、3年目にスケジュールどおりスルポンへ移転できるかどうかは、インドネシア側の予算の状況によって決まる。

これに対し、調査団は、基本的にはインドネシア側の政策であるためコメントする立場にはないとしながらも、次頁のような見解を述べた。

(1) 技術協力のサイトを協力期間中に移動させることは、過去の経験に照らしても、好ましいことではない。

(2) 分析機器等の機材の移転は、解体、運搬、据付、調整を再び必要とするので、問題がある。

(3) パイロットプラントをバンドンに建設することは、不可能ではないが、環境等の諸条件を考慮すれば適切とはいえない。

(4) 従って、あらゆる方途を求めて、スルボンを本件プロジェクトのサイトとすることが出来るように努力すべきであろう。

上記のコメントに対し、インドネシア側からはスルボン移転について努力する旨の意図表明があった。

4.5 プロジェクトの目的

本件プロジェクトの目的は、インドネシア産低品位ニッケルラテライト鉱の処理に対し適切と思われる技術を移転することにある、ということで双方の意見が一致した。その背景として、インドネシア側は、過去4年間にわたってＪＩＣＡが協力した、個別派遣専門家による実験室規模での成果を活用、発展させ、パイロットプラントによる試験を行ない、工業化に必要なエンジニアリングデータと経済評価に必要なデータを取得し、最終的には、国営企業 ANEKA TAMBANG による企業化を目指すという構想を有している。また、企業化の際に重要なファクターとなる処理コストの低減、エネルギー消費の低減、金属回収率の向上等に関しては、ＳＭＭ法の導入が必要であることを考慮し、本件プロジェクトにより適切な技術移転を目指すこととしたものと思われる。

4.6 プロジェクトの範囲

上述のように、本件プロジェクトはすでに実施されている個別派遣専門家による協力の成果をベースにしているので、その成果の評価と補足実験、未着手部分の実験室試験、原料及び産物の機器分析、及びパイロットプラントによる試験等を本プロジェクトの協力範囲とすることで双方の意見が一致した。詳細は下記のとおりである。

(1) ラテライトの乾式製錬技術

1) 鉱石の前処理技術

2) 選択還元焙焼技術

(2) ラテライトの湿式製錬技術

1) アンモニア浸出法

2) 浄 液 法

3） 塩基性ニッケル炭酸塩回収法

4） 溶媒抽出法

5） 電解採取法

(3) ラテライトの分析法

1） 原料の分析法

2） 産物の分析法

(4) パイロットプラントによる試験

4.7 プロジェクトの年次別実施計画

本件プロジェクトの年次別実施計画については、昭和６１年度を初年度として５年間で実施する計画がインドネシア側から提案された。本計画はプロジェクトサイトを当初２年間はバンドン、以後3年間はスルボンとするよう立案されているので、３年目はプラント機器の据付、調整、試運転、さらにバンドンからスルボンへの移転等を考慮しており、パイロットプラントによる試験は最後の２年間を予定している。なお、プロジェクトの開始年度を昭和６１年度としているのは、インドネシア側の希望であり、柔軟な対応が可能である。

年 次 別 実 施 計 画

項　　目	年度				
	第 1 1986	第 2 1987	第 3 1988	第 4 1989	第 5 1990
1. 実験室試験					
a. 原料及び産物の分析	———	———			
b. 鉱石前処理	———	———			
c. 選択還元	———	———			
d. アンモニア浸出	———	———			
e. 浄　液	———	———			
f. 塩基性炭酸ニッケルの回収	———	———			
g. 溶媒抽出	———	———			
h. 電解採取	———	———			
2. パイロットプラント試験					
a. 原料及び産物の分析		———	———	———	———
b. パイロットプラントの設計	———				
c. 機器の調達・製作		———			
d. 据　付			———		
e. 試運転			———	———	
f. パイロットプラントの操業				———	———

4.8 その他の事項

(1) 合同委員会

本件プロジェクトの実施に際しては JOINT COMMITEE を設立し、効率的にプロジェクトを運営することで、意見の一致をみた。

V 調 査 の 概 要

5.1 日本へ要請した背景

本件プロジェクトを日本へ要請した背景については、関係者の発言を要約すると下記のとおりになる。

(1) ニッケル鉱石、ニッケル中間産物の輸出に関しては、日本は最大の顧客である。

(2) 日本は地理的に近い。

(3) 日本はラテライトの研究・技術について高いポテンシャルがある。

(4) 現在LMN（NATIONAL INSTITUTE FOR METALLURGY）は日本とのみ二国間協力を実施している。他国との交渉はいずれも実現していない。

〔参考〕

・LMNの二国間協力（日本）

1) ITIT（1986～1988）

金属材料の防錆（工業技術院中国工業技術試験所）

2) 日本学術振興会（1986～1988）

錫鉱尾鉱からのレアメルの回収

・LMNの地域協力（1984～1987）

アセアン科学技術協力

非粘結炭からのコークスの製造

（オーストラリアからの機材供与　A$ 200,000）

5.2 PUSPIPTEK（スルポン）への移転計画

インドネシア側関係者の発言を総合すると以下のとおりである。

(1) LMNのスルポンへの移転は政府によって、すでに決定されている。

(2) しかしながら、原油価格の下落等インドネシアの経済情勢が悪化したので、全ての移転計画は中断されている。

(3) 移転計画がいつ再開されるか、その目途はない。

(4) LMNのスルポン移転に関するフランスとの交渉は失敗に終わった。

その理由は下記のとおり。

1) スルポン移転に際し、インフラストラクチャーと建物はインドネシア側が担当する。（現在、中断）

2) 機材はフランスからのローンによる。

3) このローンはインドネシア側の実質的負担となるのでBAPPENAS（NATIONAL

PLANNING BOARD）が承認しなかった。

(5) 現在、スルボンへは各国の協力が続けられている。

西ドイツ、アメリカ、スペイン、オランダ、カナダ、オーストラリア、イタリア。

(6) 日本からも「ラテライト研究施設」として、スルボンへの協力が得られないか。

この日本への協力要請（建物と機材と技術協力）については下記の政府職員から発言された。

・Prof. Dr. Muhammadi, Deputy Chairman for Technology, LIPI.
・Dr. Djoewito Atmowidjojo, Director, LMN, LIPI.
・Mr. Wahid Salim, Head of Intergovermental Technical Cooperation Division, Bureau for Technical Cooperation, Cabinet Secretariat of the Republic of Indonesia.
・Mr. Gunaman Sakri Soemargomo, Dorector of Planning, Office of the Minister of State for Research and Technology.

5.3 ローカルコストの負担能力

技術協力プロジェクトの効果的な実施には、インドネシア側によるローカルコストの確保が重要である旨、調査団から繰り返し説明したところ、インドネシア側からは、ローカルコストの確保に努力する旨の発言が、下記の関係者からあった。

(1) Mr. Wahid Salim, Cabinet Secretariat

- 本件はインドネシア政府としてプライオリティが高いので、BAPPENASへも強く要請する。

(2) Dr. Muhammadi, Deputy Chairman for Technology, LIPI

- ラテライトプロジェクトは国家開発計画のなかで、高いプライオリテイが与えられている。
- ニッケル埋蔵量は世界第三位なので、この資源を生かすべく政府は重要な位置付けを与えている。現在、金属市況は悪いが、そのポテンシャルはいつか生かされると思う。
- ローカルコストの確保についてはＬＩＰＩがその責を負っており、政府に対して強く要請することにしている。

(3) Dr. Djoewito, Director, LMN, LIPI

- 同上主旨の発言あり。
- 日本との技術協力が確定すれば、ＬＭＮの予算には相当額（１０数％）が優先的に加算されることになっている。
- ＬＭＮの予算（１９８４～１９８７）実績は下表のとおりである。

（Ｒｐ）

種　　別	1984／85	1985／86	1986／87
開発予算	677,824,500	700,403,000	680,244,000
経常予算	180,090,600	190,594,200	261,389,200
計	857,915,100	890,997,200	941,633,200 （約1億5700万円）

- 全予算（ＬＭＮ）の内訳は下表のとおりである。

	84／85	85／86	86／87
給与	27.1（％）	30.2（％）	38.0（％）
材料費	22.9	20.4	33.4
機材費	12.2	13.1	15.0
修理費	1.8	2.4	2.3
輸送費	4.1	6.4	4.7
建設費	27.5	23.8	2.9
庁費	2.0	2.1	2.0
その他	2.4	1.6	1.7
計	100.0	100.0	100.0

5.4 カウンターパートの配置計画

本件プロジェクトの実施に際し、カウンターパートの確保が重要であることについては、前記のローカルコストの確保と同様にインドネシア側はその確保に努力する旨、関係者がそれぞれ発言した。

現在、ＬＭＮは下記のような組織で構成されているが、そのうち Extractive Metallurgy Division が本件プロジェクトを担当することになっており、そのための運営組織についても説明があった。

LMN 職員配置の現状

（人）

学歴 / 部門	Ir.	B.E.	その他	計
所長	1			1
副所長（研究担当）	1			1
〃 （開発 〃 ）	1			1
総務部	3	2	48	53
一般サービス部	4	−	20	24
腐食対策技術部	10	2	6	18
金属加工技術部	8	11	21	40
製錬技術部	19	10	22	51
計	47	25	117	189

プロジェクト推進体制（インドネシア側）

プロジェクトコーディネーター	LMN所長
プロジェクトリーダー	LMN副所長（研究担当）
実験室試験担当コーディネーター	Ir. EDDY DWI TJAHJONO
パイロットプラント担当コーディネーター	Ir. RONALD NASUTION
研究員	11名
テクニシャン	21名

本件担当カウンターパートのうち、研究員ら１３名の学歴等は下記のとおりで、日本への留学経験者もかなり含まれている。

カウンターパート	出身大学	留学・研究先	担当
EDDY	ＩＴＢ＊	公資研	製錬
FIRDIYONO	〃	京大	〃
AKSKADI	〃	早大	〃
ISMI	〃		〃
PUGUH	〃		〃
RUSTIADI			〃
ARIFIN	ＩＴＢ		〃
DEDY	〃	京大	〃
RUDY	〃	早大	〃
SUHARIS	〃		〃
ADIL		学振による日本留学	〃
SRI		英国	分析
RONALD			パイロットプラント

＊　ＩＴＢ　バンドン工科大学

5.5　専門家派遣に関する要請

専門家派遣に関して、インドネシア側から下記のような要請があった。

専門家派遣要請計画

種別	人数（名）	期間（月）	合計（M・M）	年度 1986	1987	1988	1989	1990
(1) 長期専門家								
1）製錬（乾式）	1	60	60	←―――	―――	―――	―――	―――→
2）製錬（湿式）	1	60	60	←―――	―――	―――	―――	―――→
3）分析	1	60	60	←―――	―――	―――	―――	―――→
(2) 短期専門家								
1）製錬一般	1	5	5	←―――	―――	―――	―――	―――→
2）分析一般	1	5	5	←―――	―――	―――	―――	―――→
3）分析機器操作	5	3	15	←―――	―――→			
4）パイロットプラント	4	3	12			←―――	―――	―――→
計	14		217					

5.6 カウンターパート受入れに関する要請

カウンターパート受入れに関して、インドネシア側から下記のような要請があった。

分野	人数（人）	期間（月）	合計（M•M）	年度 1986	1987	1988	1989	1990
(1) 製錬技術	8	6	48	←	—	—	→	
(2) 機器分析技術	4	6	24	←	—	→		
(3) プロセスコントロール	2	6	12			←	→	
計	14		84					

5.7 機材供与に関する要請

機材供与に関し、インドネシア側から下記のような要請があった。

(1) 機材分析用機材　　10点

(2) 実験室用機材　　4点

(3) データ処理用コンピュータ　　1点

(4) 図書

(5) パイロットプラント用機材　　1式

1) 鉱石前処理用機材　　（3t／日）

2) 還元焙焼用機材　　（3t／日）

3) アンモニア浸出用機材　　（5㎥／日）

4) 塩基性ニッケル炭酸塩回収用機材　　（90Kg／日）

5) 溶媒抽出用機材　　（5㎥／日）

6) Ni、Co電解採取用機材　　（450ℓ／日）

7) 公害防止用機材

8) 計製・制御用機材

9) 配管配線用機材

10) その他

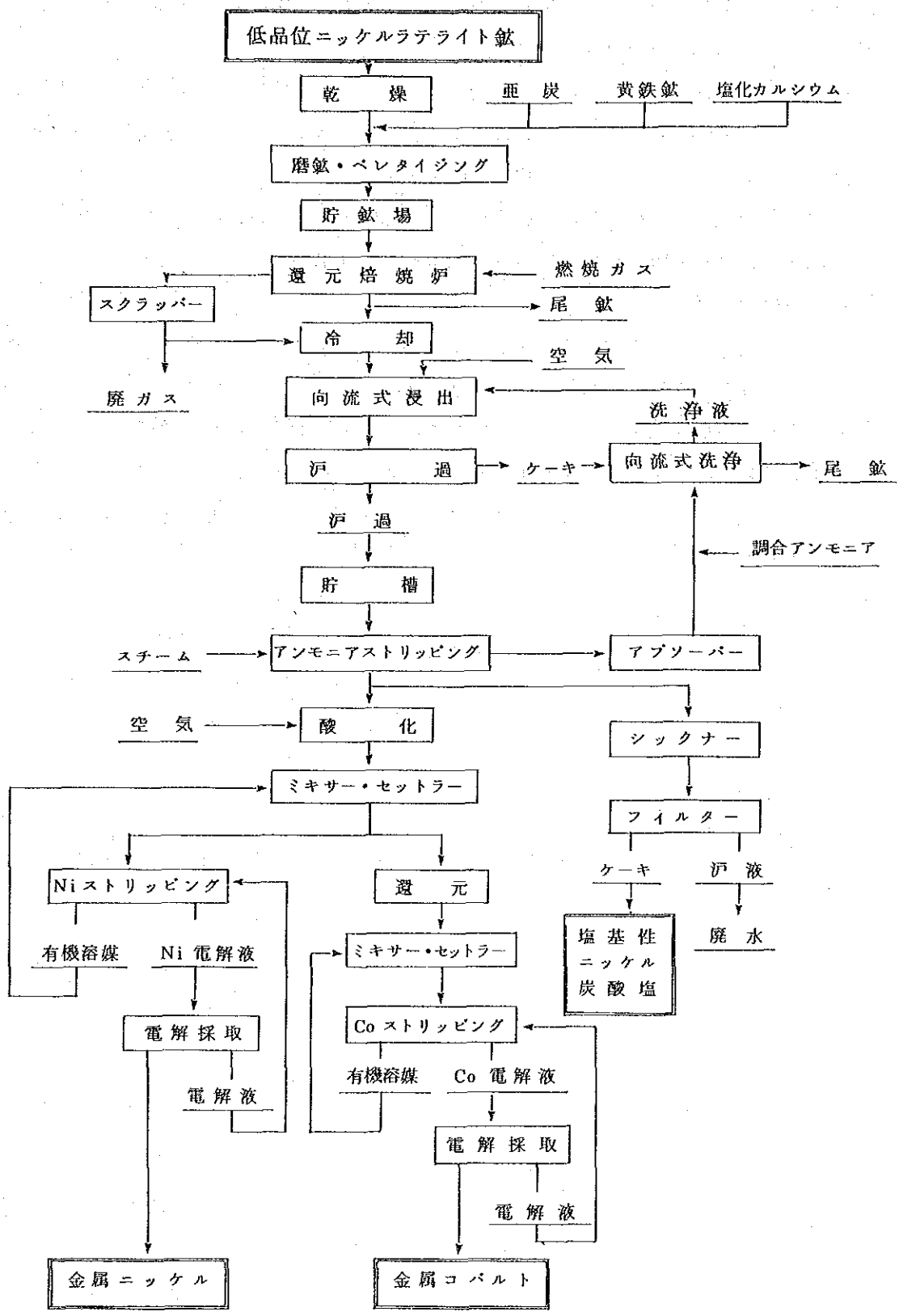
上記パイロットプラントのフローシートは次頁のとおりである。

5.8 その他の事項

(1) ANEKA TAMBANG の協力

1) ANEKA TAMBANG の社長 Mr. Kosim は調査団に対し、本件プロジェクトに対しては全面的に協力する旨言明し、今後、本件プロジェクトによって成果が得られれ

パイロットプラント系統図（フローシート）



ば、積極的にその工業化を図りたいとのことである。

2）従って、本件プロジェクトに供されるラテライト鉱はPOMALAA鉱となり、次いでGEBE鉱になるものと思われる。

(2) 専門家への便宜供与

1）インドネシアにおいては、コロンボプラン専門家に対する便宜供与の統一基準はなく、個別プロジェクト毎にR／Dに記載する由である。

2）今回の調査においては、LMNを含めインドネシア側で十分に協議されていなかったため、便宜供与の範囲を具体的に明らかにすることは出来なかった。

(3) 専門家の生活環境

1）バンドンの場合は、多数の日本人が居住し、日本人学校も設立されており、住宅、食糧、治安も含めて、とくに問題はないと思われる。

2）スルボンの場合は、ゲストハウスが整備されつつあるが、スルボンに近いジャカルタ地域に居住して、スルボンへ通勤するのが実際的であると思われる。

ジャカルタについては、すでに多数の日本人が居住しているので生活関係の情報は容易に入手できる。

Ⅵ 協 議 の 結 果

インドネシア側との協議結果は、MINUTES OF MEETINGとしてとりまとめ、LIPI長官との間で署名交換を行なった。

M／Mの内容を大別すれば以下のとおりになる。

(1) 合意事項

A. プロジェクト名

B. プロジェクト実施機関

C. プロジェクト協力期間

E. プロジェクトの目的

F. プロジェクトの範囲

J. ジョイントコミッティーの設置

(2) 要請事項

G. 専門家派遣、研修員受入、機材供与

H. プロジェクト実施計画

(3) 説明事項

D. プロジェクトのサイト

(4) 了解事項

I. ローカルコストとカウンターパートの確保

J. 日本のプロジェクトタイプ技術協力のシステム

Ⅶ　今後への留意事項

(1)　技術協力の妥当性

本件プロジェクトはインドネシアの莫大な低品位ニッケル資源の活用を目指すものとして、インドネシア政府としては高いプライオリティを与えており、また、実施機関である国立冶金研究所（ＬＭＮ）においては、すでに４年間にわたりＪＩＣＡ派遣専門家の指導の下に、実験室規模での試験を行なって、国際学会での発表などの成果を得ているので、今後、パイロットプラント規模でのプロジェクトタイプの技術協力へと進展させることは妥当であると思われる。

（因みに、ＬＭＮにおいては、すでに低品位鉄鉱石を対象として2.5ｔ／日の規模で熔鉱炉の連続試験を行ない、その成果をもとにして、南スマトラ、ランポンの鉱山に２５ｔ／日のプラントを建設し、２カ月間、連続操業を行なった実績がある）

(2)　今後への留意事項

しかしながら、今後、協力の実施へ向けての段階では、プロジェクトサイトの件が重要な問題となることは明らかである。

インドネシア側では、今後、①ＢＡＰＰＥＮＡＳなど政府中枢部に交渉して、スルポンにパイロットプラント用建屋を建設する特別承認を取得するよう努力するとともに、また、②日本政府へのラテライト研究施設の設立に関する無償資金協力と技術協力とを一括して申請するよう関係機関に交渉することにしたいとのことである。

従って、日本側としては、情勢に応じて、適切に対処できるよう慎重に推移を見守る必要がある。

また、低品位ラテライト鉱の処理技術については、ＳＭＭ法を導入することについてインドネシア側が理解を示しているので、協力の実施に際しては、所期の目的を達成されるよう、日本側としては実効ある技術移転に努力すべきである。

＜　資　料　1　＞

議　　事　　録

(MINUTES OF MEETING)

MINUTES OF MEETING

ON

TECHNICAL COOPERATION FOR THE PROJECT

ON RESEARCH AND DEVELOPMENT OF LOW GRADE NICKEL LATERITES

IN THE REPUBLIC OF INDONESIA

The Japanese Preliminary Survey Team (hereinafter referred to as the "Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Dr. Kenji Tomita, Special Technical Advisor of JICA, visited Indonesia from March 21 to March 29, 1986, for the purpose of clarifying the outline and background of the Indonesian proposal as well as studying the feasibility on the Japanese Project-Type Technical Cooperation for the Project on Research and Development of Indonesian Low Grade Nickel Laterites (hereinafter referred to as the "Project").

During its stay in Indonesia, the Team exchanged views and had a series of discussions with the officials of LIPI (Indonesian Institute of Sciences), Puspiptek (Center for Science and Technology), Cabinet Secretariat and also made a field survey to the relevant sites and facilities.

As a result of the discussions, both parties came to the understanding concerning the matters referred to in the document attached herewith.

Jakarta, March 29, 1986

富田堅二

Dr. KENJI TOMITA
Leader,
Preliminary Survey Team,
Japan International
Cooperation Agency

Prof. Dr. D. A. TISNA AMIDJAJA
Chairman,
Indonesian Institute of Sciences
(LIPI)

ATTACHED DOCUMENT

A. NAME OF THE PROJECT:

RESEARCH AND DEVELOPMENT OF INDONESIAN LOW GRADE NICKEL LATERITES.

B. PROJECT IMPLEMENTATION AGENCY:

National Institute for Metallurgy, Indonesian Institute of Sciences.

C. DURATION OF THE PROJECT:

The duration of the Japanese technical cooperation would be five (5) years from the date of signing of the Record of Discussions (R/D).

D. LOCATION OF THE PROJECT:

As to the location of the Project, Indonesian side explained as follows;

1. The Project would be carried out in Bandung, during the beginning two years.
2. And after that, all the staffs and equipment concerned will move to the Puspiptek in Serpong, when the Pilot Plant building and infrastructure are available.
3. However, it depends on the condition of national budget whether the Project site will be removed on schedule or not in the third year.

E. OBJECTIVE OF THE PROJECT:

The objective of the Project is to transfer the appropriate technology for the treatment of Indonesian low grade nickel laterites.

F. SCOPE OF THE PROJECT:

1. Pyrometallurgy for Laterite:
   a. Ore Preparation.
   b. Selective Reduction.
2. Hydrometallurgy for Laterite:
   a. Ammonia Leaching.
   b. Purification.
   c. Recovery of Basic Nickel Carbonate.
   d. Solvent extraction.
   e. Electrowinning.
3. Analysis for Laterite:
   a. Analysis of Raw Materials.
   b. Analysis of Products.
4. Operation of the Pilot Plant.

G. PROPOSAL FROM THE INDONESIAN SIDE:

The Indonesian side requested for dispatch of Japanese experts, acceptance of Indonesian counterpart personnel in Japan, and provision of equipment and materials as shown in Annex 1,2,3 and 4.

H. SCHEDULE OF THE PROJECT:

The Indonesian side proposed the project implementation schedule as shown in Annex 5.

I. ALLOCATION OF MAN-POWER AND OPERATIONAL COSTS BY THE INDONESIAN SIDE:

1. The Team stressed that the sufficient allocation of man-power and operational costs for the Project is very important.
2. Related to the above, the Indonesian side explained that they would make efforts to get necessary man-power and operational budget.

J. OTHER MATTERS:

1. The Team explained the Project-Type Technical Cooperation system by the Government of Japan and the Indonesian side understood it.
2. Both sides agreed that a Joint Commitee should be established for the effective and successful implementation of the Project.
3. The Indonesian side proposed the management system of the implementation of the Project as shown in Annex 6.

Annex 1:

DISPATCH OF JAPANESE EXPERTS

1. Long term experts:

Field	Number	Fiscal Year				
		1986	1987	1988	1989	1990
Metallurgy	2	==========	==========	==========	==========	==========
Analysis	1	==========	==========	==========	==========	==========

2. Short term experts:

a. Experts for specific fields in metallurgy and analysis:

1 or 2 persons, 3 weeks, every year.

b. Experts for installation and operation of analytical and laboratory equipment:

- 3 persons, 3 months in 1986 for DTA, infrared and EPMA.
- 2 persons, 3 months in 1987 for x-ray diffracto-meter and fluorescence x-ray analyzer.

c. Experts for design and installation of pilot plant:

- 4 persons, 3 months.

Annex 2:

TRAINING OF COUNTERPART PERSONNEL IN JAPAN

Field	Number	Term	Fiscal Year
1. Differential thermal analyzer	1	6 months	1986
2. Electron probe micro analyzer	1	6 months	1986
3. Infrared absorption spectro meter	1	6 months	1986
4. Laterite metallurgy	2	6 months	1986
5. X-ray diffraction & fluorescence	1	6 months	1987
6. Laterite metallurgy	2	6 months	1987
7. Laterite metallurgy	2	6 months	1988
8. Process control	2	6 months	1988
9. Laterite metallurgy	2	6 months	1989

Annex 3:

LIST OF EQUIPMENT REQUESTED

A.ANALYTICAL AND LABORATORY EQUIPMENT

1.	Electron Probe Micro Analyzer (Shimadzu, EPM-810S. 2 CH)	1 set
2.	Fluorescence X-Ray Spectrometer,(Shimadzu,VF-320)	1 set
3.	X-Ray Diffractometer (Shimadzu, XD-5A)	1 set
4.	Micro DTA-TG (DTG) System (Shimadzu)	1 set
5.	Polarograph, (YAMATO Model P-900)	1 set
6.	Infrared Spectrometer, (Shimadzu, IR-435)	1 set
7.	Carbon Analyzer	1 set
8.	Non-oxidation Atmosphere Oven (Tabai Model IPS-222), W/out Gas Cylinder	1 set
9.	Differential Scanning Calorimetry System	1 set
10.	Electronic Moisture Balance	1 set
11.	Micro Computer for data processing	1 set
12.	Vacuum Drying Oven (YAMATO, Model DP-61)	1 set
13.	Vacuum Pump (YAMATO Model PD-135)	1 set
14.	Centrifuge Separator (HITACHI, MODEL. 05P-21)	1 set
15.	Labo Stirrer (YAMATO Model LR-51 ATF)	1 set
16.	Books	as needed

B.PILOT PLANT EQUIPMENT

1. Ore preparation (Cap. 3tons/day)

Coarse Ore Bin	1 set
Equipment for Drying, Crushing, Grinding and Sizing	1 set
Fine Ore Bin	1 set
Coal Bin	1 set
$CaCl_2$, Pyrite and other raw material Bin	3 sets
Pelletizer	1 set
Belt conveyor	4 sets
Others	as needed

2. Reduction Furnace (Cap. 3tons/day)

Annular Vertical Kiln (With Hot Stove, Charging Unit)	1 set
Fuel Oil Service Tank	1 set
Gas Scrubber	1 set
Gas Blower	1 set
Pellet Cooler	1 set
Others	as needed

3. Ammonia Leaching (Cap. 5 m^3/day)

Leaching Tank	3 sets
Thickener	3 sets
Filter Press	1 set
Pregnant Solution Storage Tank	1 set
Washing Tank	1 set
NH_3 Stripping Equipment	1 set
Steam Generator	1 set
NH_3 Condenser (Absorber)	1 set
Pumps	6 sets
Others	as needed

4. Basic Nickel Carbonate Recovery (Cap. 90 kgs/day)

Thickener	1 set
Filter Press	1 set
Pumps	2 sets
Others	as needed

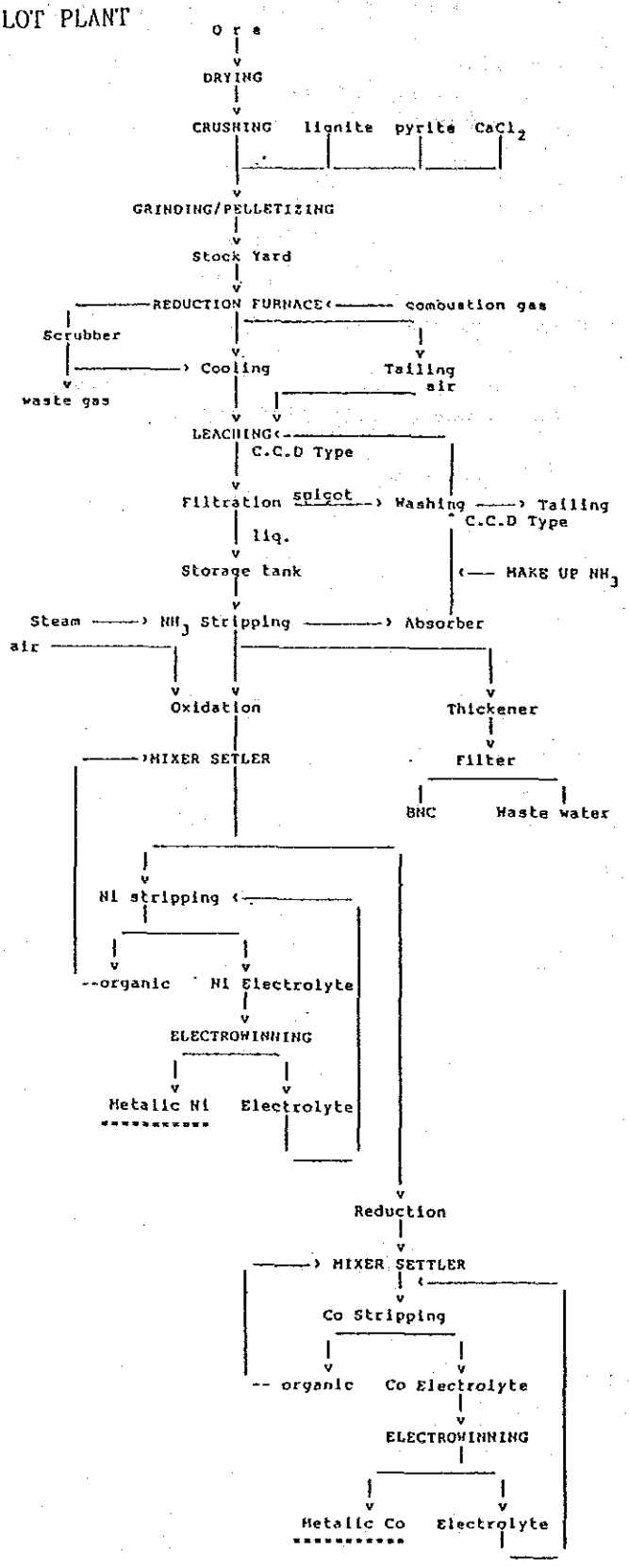
5. Solvent Extraction (Cap. 5 m^3/day. Pregnant solution)

Oxidation Tank	2 sets
Mixer - Settler for Ni	8 sets
Mixer - Settler for Co	6 sets
Pumps	7 sets
Immersion Heater	4 sets
Reduction Tank	1 set
Others	as needed
(Including Solvent Lix-64N, Lix-54)	

6.	Electrowinning for Ni & Co (Cap. 450 l/day electrolyte)	
	Rectifier	2 sets
	Electrowinning Cells	3 sets
	Bus - Bars	1 set
	Anodes	1 set
	Pumps	4 sets
	Others	as needed
7.	Environmental Control Equipment	1 set
8.	Instrumentation and Control Unit	1 set
9.	Gas Duct, Piping and Wiring Material for process excluding Utility Line	1 set
10.	Miscellaneous	as needed

Annex 4

FLOWSHEET OF THE PILOT PLANT



Annex 5:

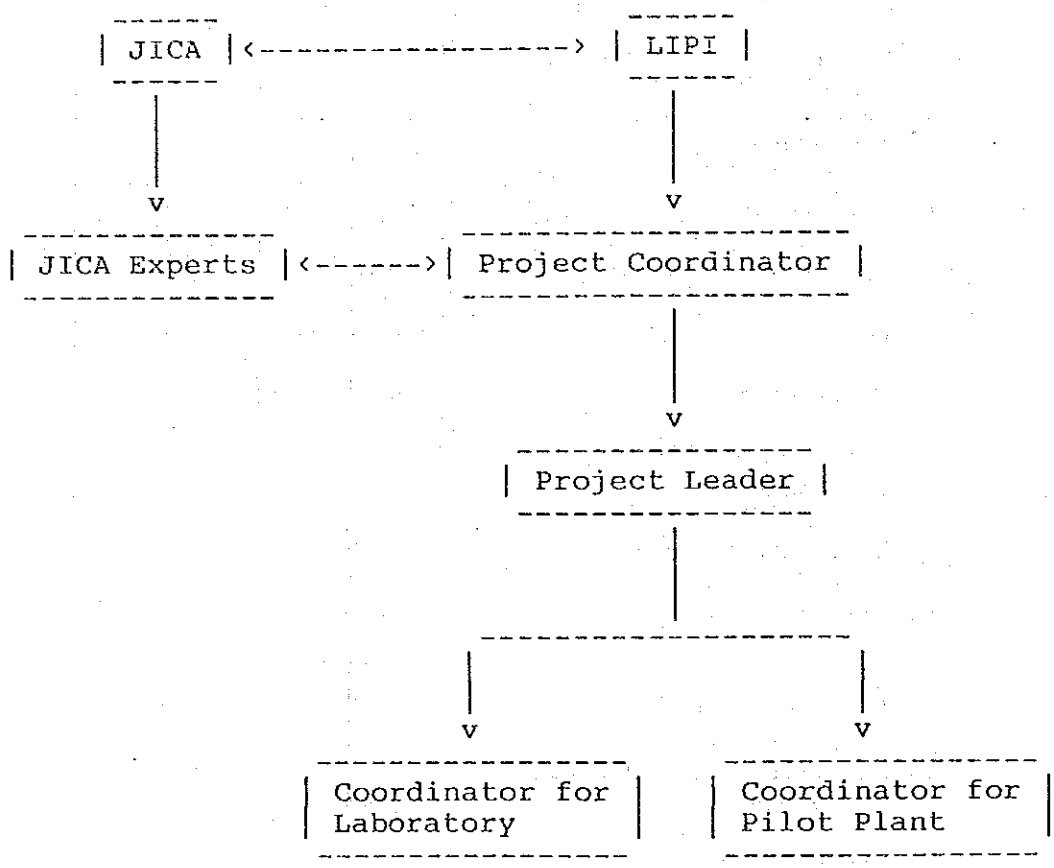
IMPLEMENTATION SCHEDULE OF THE PROJECT

Subject	Fiscal Year				
	1 st 1986	2 nd 1987	3 rd 1988	4 th 1989	5 th 1990
1. Laboratory Experiment:					
a. Analysis of raw materials and products	==========	==========			
b. Ore preparation	==========	==========			
c. Selective reduction	==========	==========			
d. Ammonia leaching	==========	==========			
e. Purification	==========	==========			
f. Recovery of Basic Nickel Carbonate	==========	==========			
g. Solvent extraction	==========	==========			
h. Electrowinning	==========	==========			
2. Pilot Plant Experiment:					
a. Analysis of raw materials and products			==========	==========	==========
b. Design of the pilot plant	===				
c. Procurement & manufacture of equipment		======			
d. Installation			====		
e. Performance test			====	=	
f. Operation of the pilot plant.				==========	==========

Annex 6:

PROPOSED MANAGEMENT SYSTEM FOR THE IMPLEMENTATION OF THE PROJECT

A. ORGANIZATION



B. PERSONNEL

(1). Project Coordinator :

Ir. Djoewito Atmowidjojo

(2). Project Leader :

Ir. Sukarna Djaja

(3). Coordinator for Laboratory Experiment :

Ir. Eddy Dwi Tjahjono

(4). Coordinator for Pilot Plant :

Ir. Ronald Nasution

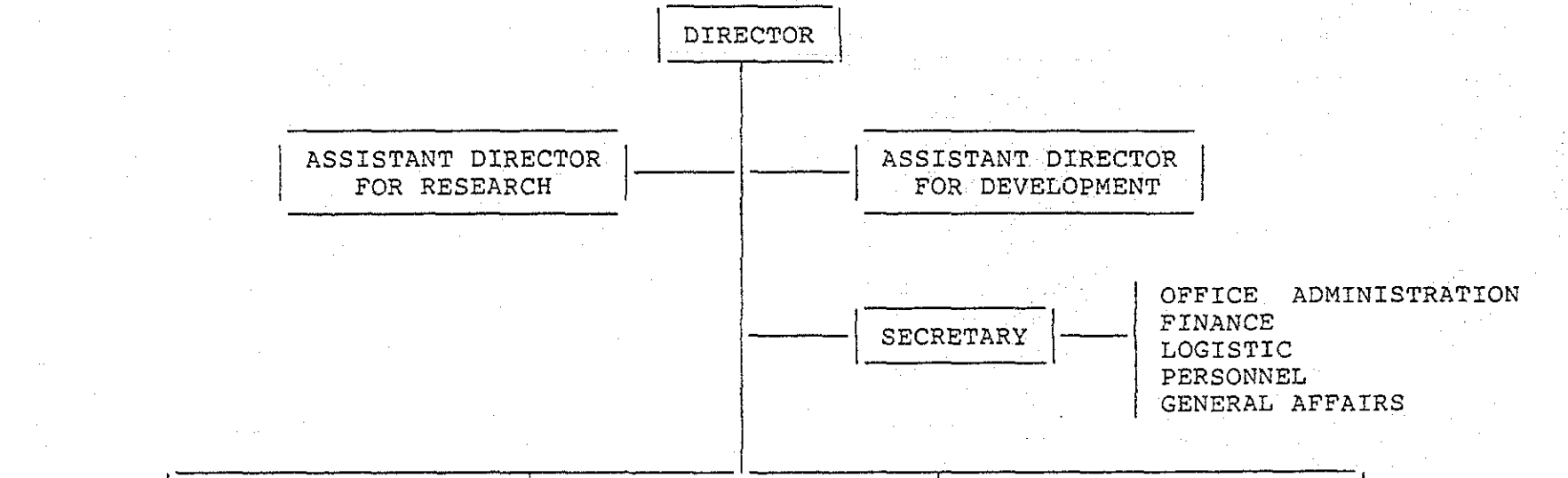
Researcher :

Ir. F. Firdiyono	Dedy Sufiandi, BE
Ir. Akskadi Djohari	Ir. Rudy Subagja
Ir. Ismi Handayani	Suharis, BE
Ir. Puguh Prasetyo	Ir. Adil Jamali
Ir. Rustiadi Purawiardi	Dra. Sri Murdiati
Ir. Arifin Arif	

Technician :

David Herwana	Karlan
Muhamad Yahya	Asep Suhana
Suhud	Ngadiyo
Waluyo	Samsu Bekti
Mimin Suminar	Sukiman
Santoso	Wawan Wartawan
Mukhamad Angwar	Susanto
Rahmat	Dony Arifin
Gunawan Tri Djoko P.	Sugiarti
Koeswara	Cucu Herliani
Dibyo	

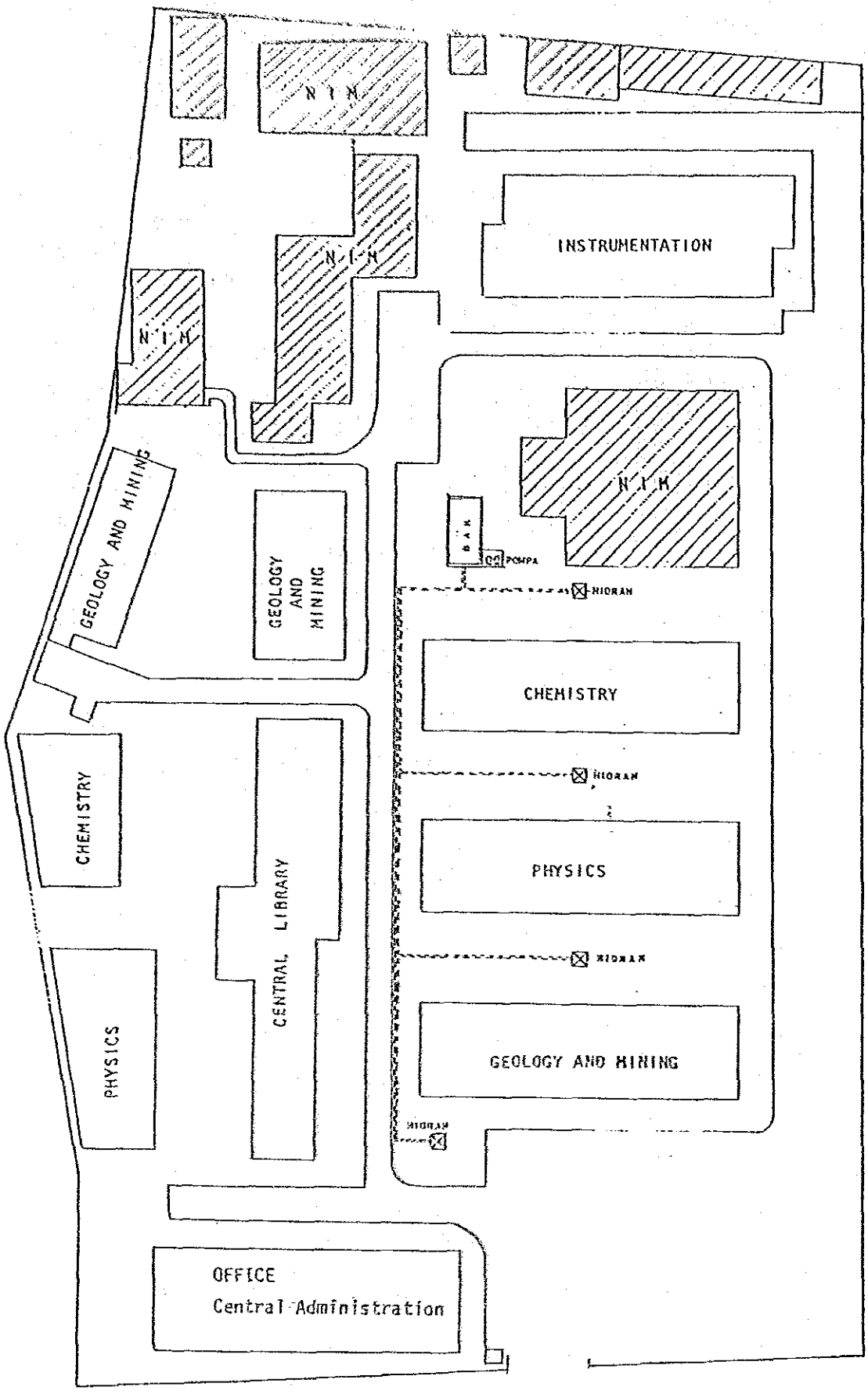
PRESENT ORGANIZATION OF LMN - LIPI



GENERAL SERVICES DIVISION CHIEF	CORROSION DIVISION CHIEF	METALS TECHNOLOGY DIVISION CHIEF	EXTRACTIVE METALLURGY DIVISION CHIEF
- Chemical analysis. - Mettalography & physic lab. - Mechanical test lab. - Non-destructive test lab. - Workshop & maintenance lab. - Documents & informatics.	- Electrochemical corrosion lab. - Dry and high temperature corrosion lab. - Stress corrosion lab. - Chemical & industrial corrosion lab. - Atmospheric corrosion lab.	- Melting & Casting lab. - Rolling, forging, forming & machinning lab. - Heat treatment lab. - Welding & brazing lab. - Surface treatment & coating lab.	- Geology & mineralogy lab. - Mineral dressing lab. - Hydrometallurgy lab. - Pyrometallurgy lab. - Preparation pilot. - Mineral dressing pilot. - Hydrometallurgy pilot. - Pyrometallurgy pilot.

LIPI

LABORATORIES
PLAN LAYOUT
IN BANDUNG



BUDGET

	84/85	85/86	86/87
Development Budget	677.825.000	700.403.000	680.244.000
Rutine/Budget	181.622.600	192.542.200	263.337.200

BREAK DOWN OF DEVELOPMENT BUDGET

	84/85	85/86	86/87
- Additional Salaries	79.380.000	122.220.000	140.544.000
- Land	30.000.000	-	-
- Materials	189.282.000	181.450.000	314.250.000
- Equipment	100.600.000	116.750.000	141.215.000
- Transportation fee	34.222.500	56.683.000	44.727.000
- Construction	227.880.000	212.500.000	27.750.000
- Others	16.460.000	10.800.000	11.758.000
	677.825.000	700.403.000	680.244.000

BREAK DOWN OF RUTINE BUDGET

	84/85	85/86	86/87
Basic salary	145.267.079	146.850.600	217.695.600
Office materials and supplies (phone,elect,gas, water)	16.950.700	18.593.750	18.543.750
Maintenance	14.815.571	21.481.850	21.481.850
Miscellaneous	3.057.250	3.668.000	3.668.000
	181.622.600	192.542.200	263.337.200

List of major equipment

Division of Extractive Metallurgy

A. Equipment for Sample Preparation

1. Laboratory size Jaw Crusher
2. Laboratory pulverisers
3. Laboratory size ball mill
4. Laboratory testing sieves and shaker
5. Laboratory size flotation machines
6. Laboratory magnetic separator
7. Drying ovens
8. Microscopes

B. Equipment for Mineral Processing

9. Muffle furnaces - 1200°C
10. Horizontal type tube furnace - 1500°C
11. High frequency induction furnaces
12. Small size Rotary kiln/furnace
13. Roasting furnaces fluidized type
14. Equipment for electowinning

C. Equipment for Chemical Analysis

15. Atomic Absorption Spectro Analyzer
16. Spectro photometer
17. Equipment for wet method chemical analysis

D. Accessory equipment

18. Vacuum pumps

19. Air compressors

20. Analytical balances

21. Technical balances

22. Optical and electronic temperatur controller

＜ 資　　料　　2 ＞

国立治金研究所（ＬＭＮ）概　要

SERVICES OF THE NATIONAL SCIENTIFIC DOCUMENTATION CENTRE L I P I

Jl. Jen. Gatot Subroto, Jakarta
Phone : 511063, 583465

LIBRARY

Members of the Library may borrow books from the library's collections, which cover the fields of natural science and technology. Periodicals may be read only in the library.

DOCUMENTATION

- Literature searches for scientific literature needed by a research worker.
- Preparation of bibliographies on special subjects for the basis of research or surveys.
- Circulation of *Informasi Kilat*, a current awareness service by which the user is sent copies of the contents tables of current periodicals which he selects. Photocopies will be made of any article or paper required by the user.
- Translation service.

REPRODUCTION

Offset printing, stenciling, photocopying and negative or positive microfilming.

INDONESIAN INSTITUTE OF SCIENCES (LIPI)

Introduction.

Scientific activities in Indonesia were initiated early in the 16th century, by Jacob Bontius and others who made a study of Indonesian flora. In the late 16th century, the work of Rumphius, "Herbarium Amboinense", was very famous. The "Bataviaasch Genootschap voor Kunsten en Wetenschappen", (Batavian Society for Arts and Sciences), was established at the end of the 18th century and the "s'Lands Plantentuin ", (Botanical Garden), was set up in Bogor by C.G.C. Reinwardt, in 1817. Over a century later, the "Natuurwetenschappelijke Raad voor Nederlandsch–Indië, (Dutch-Indies Council for Natural Sciences), and the "Organisatie voor Natuurwetenschappelijk Onderzoek", (Organization for Natural Sciences Research), were created in 1928 and 1948 respectively.

After the proclamation of Indonesian Independence on August 17, 1945 the Government of Indonesia began to study the existing administrative structure – including the structure of scientific research – to carry out the reforms necessary to meet the aspirations of sovereign Indonesia. Thus,the "Council for Sciences of Indonesia," (Madjelis Ilmu Pengetahuan Indonesia (M.I.P.I.), was founded under Act No. 6, 1956, and entrusted with the following tasks :

1. to promote and guide endeavour in the field of science and technology;
2. to advise the Government on matters of Science Policy.

It may be mentioned that MIPI was an autonomous organization under the Ministry of Education. It did not administer any scientific research institutions.

In 1962, the Government of Indonesia created a Ministry for National Research and MIPI, as an autonomous body, was then transferred to this Ministry,

with the additional task of establishing and administering a number of national research institutions. About four years later, due to the Government's efforts at simplification, the Ministry for National Research lost its status as a Ministry and became an ordinary "Institute for National Research", (LEMRENAS). In early 1967, the Provisional Peoples Consultative Assembly abolished this institute and instructed the Government to set up the Lembaga Ilmu Pengetahuan Indonesia (Indonesian Institute of Sciences – LIPI).

Then by Presidential Decree No. 128, 1967, LIPI was established to take over and continue the tasks of the "Institute for National Research" (LEMRENAS), and the "Council for Sciences of Indonesia" (MIPI).

Status, aim and tasks of LIPI.

LIPI is a Government body which provides guidance in the field scientific and technological research. It reports directly to the President of the Republic of Indonesia.

The creation of LIPI is aimed at obtaining maximum efficiency and effectiveness in carrying out scientific and technological research for the welfare of mankind in general and for the welfare of the nation in particular.

The main tasks of LIPI are defined as follows :

1. to promote the development of science and technology in Indonesia for the benefit of mankind in general and of the Indonesian people in particular;
2. to search for scientific truth, while scientific freedom, the freedom of conducting research, and academic freedom are recognized and guaranteed within LIPI in so far as it is not in contradiction with "Pancasila" and the 1945 Constitution;

In order to accomplish these tasks, LIPI is assigned the following functions :

1. to advise the Government on the formulation of a national science policy as part of the overall national policy;

2. to give guidance to research institutions, and to develop existing technological activities;
3. to guide research workers towards a higher sense of awareness and responsibility, to facilitate rapid development of science and technology in Indonesia;
4. to encourage and develop science-mindedness among the Indonesian people;
5. to conduct and maintain relations and cooperation with international – as well as national – scientific bodies in accordance with existing regulation.

In line with its main tasks and functions, LIPI is authorized to coordinate, integrate and synchronize all activities in the field of science and technology at both the national and regional level.

Activities of LIPI.

In conformance with its tasks and competence, LIPI is obliged to carry out activities in the following fields :

I. to conduct its own research;
II. to assist the Government in the formulation of science policy;
III. to act as an advisory body for Government Agencies in matters related to science;
IV. to coordinate, integrate, and synchronize activities in the field of science and technology at the national and regional level;
V. to develop or participate in the efforts to strengthen the field of science and technology;
VI. to implement or participate in the application of science and technology to national development;
VII. to increase public understanding of the role of science and technology in national development;
VIII. to carry out scientific activities at regional and international levels.

Ad. I. CARRYING OUT ITS OWN RESEARCH.

The Decision of the Provisional Peoples Consultative Assembly No. II/MPRS/1960 provides that, in addition to government bodies which carry out research in their own institutes such as in the Departments, Universities etc., it is necessary to organize a national research organization which will conducts research oriented towards obtaining information and data necessary for national development..

The body designated to perform this task was the Council for Sciences of Indonesia (MIPI) and, with the merger of MIPI and the Institute for National Research on the basis of Presidential Decree No. 128, 1967, the tasks of conducting oriented research was entrusted to LIPI.

LIPI has ten national research institutions situated in Jakarta, Bogor, Bandung and Serpong which are conducting research in the natural, technological and social sciences and humanities. In addition to these institutions there is a National Scientific Documentation Centre which does not carry out research activities but performs certain important functions as a body which :

a. assists research both inside and outside LIPI by providing scientific literature for research workers;

b. provides information on science and technology;

c. provides information on scientific and documentation sources in Indonesia and abroad, particularly in Southeast Asia;

d. arranges subscription to domestic and foreign scientific periodicals particularly for research institutions of LIPI.

The national research institutions administered by LIPI are :

1. NATIONAL BIOLOGICAL INSTITUTE

This Institute consists of 4 affiliate institutions, namely :

a. Hortus Botanicus (Botanic Gardens of Indonesia) with the Central Botanic Garden at Bogor (±87 ha)

and its branches: Mountain Garden Cibodas, West Java (± 60 ha), a Natural Preserve (± 1.500 ha), Garden for Drought Resistance Plants Purwodadi, Lawang, East Java (± 140 ha) and "Ekakarya' Garden Bali (± 70 ha). Two branches of the Botanic Gardens in Sumatera (Sibolangit and Padang) are, due to limited funds, still fully "attached" to the local Forest Service.

The tasks of the Botanic Gardens include: a) collection/investigation of living plants expected to have economic potential, b) carrying out genetical, morphological and ecological research and conducting tests, particularly on the improvement of the genetical characters of plants which have economic value, and providing the facilities as well as the plant materials required for biological, chemical and agricultural research in Indonesia and abroad, c) introducing plants of economic importance in developing horticulture, floraculture, plantation, forestry, etc., d) providing facilities and materials for educational purposes, and e) providing the public with the Botanic Gardens as a place for study and recreation with the aim of encouraging their interest in and appreciation of their natural resources.

The Bogor Botanic Gardens is well known internationally as one of the biggest Tropical Botanic Gardens, because of its richness in plant species and also because of the services it has rendered to the development of science over more than 154 years (1817 – 1971).

b. Herbarium Bogoriense

The activities of this Herbarium include an inventory of the Indonesian flora, many of which are still uninvestigated. It conducts research in the fields of plant taxonomy and plant ecology. Only by studying the species of the plants and their distribution can a solid foundation be laid for the utilization of the useful plants.

c. Laboratory for Botanical Research

This Laboratory is concerned with research in the fields of anatomy, plant physiology, phyto-

chemistry, microbiology and genetics. The purpose of the research is to gather scientific data on the characteristics of the individual species of plants which may have potential value.

d. Museum Zoologicum

This Museum holds the largest collection of fauna found in Indonesia. It conducts research on the various biological aspects of animals in an effort to utilize them to the benefit of the country.

It should be stated that in the implementation of regional cooperation, the National Biological Institute provides facilities for SEAMEO (Southeast Asian Ministers of Education Organization) Centre for Tropical Biology.

2. NATIONAL INSTITUTE OF OCEANOLOGY

This Institute was set up by Presidential Decree No. 10, 1970 with the purpose of encouraging the implementation of the tasks of LIPI particularly in the field of oceanology. The Institute of Marine Research, which had become the core of the National Institute of Oceanology, was previously one of the five daughter institutions of the National Biological Institute. At present, the National Institute of Oceanology has two research centres, namely at Pulau Pari, Jakarta and Ambon. The research centre at Ambon at the present stage is provided with some facilities received from the previous Project of the Ambon Institute of Technology in the context of co-operation between LIPI and the Ministry of Education.

The National Institute of Oceanology is entrusted with the task of conducting and coordinating various fields of marine research, such as marine biology, physical and chemical oceanography, marine geology, marine meteorology, etc. As an island state possessing vast seas, Indonesia has to exploit and utilize its marine resources as extensively as possible.

3. NATIONAL INSTITUTE OF GEOLOGY AND MINING

In the framework of research and survey on mineral resources, this Institute operates in the field of "mission

oriented" geology and mining. Main problems related with development are identified and made the objectives for further research. Since 1967 mineral exploration in Indonesia has increased tremendously with the existence of dozens of foreign entrepreneurs conducting mineral exploration. Together with the Government, hundreds of millions of dollars have been spent in exploration and on the collection of data. Consequently, it is necessary to ensure that these data are not be carelessly lost. The Institute also has the task of gathering, systematizing and preserving the existing scientific data in order that they can be used by forthcoming generations. The data constitute an invaluable scientific source, both in searching for mineral deposits and in attempts to revise the old theories on the geology and mineral deposits of this region.

Research in the field of minerals cannot be conducted without the existence of an adequate laboratory service. The National Institute of Geology and Mining does some work in this field to gather data, make analyses etc., with the main purpose of assisting research in the field of minerals.

A scientific approach in the development of mineral resources is necessary to avoid excessive exploitation; this is a matter that cannot be tolerated, because minerals are a non-renewable natural resource.

In Bandung there are five institutes grouped together in the National Research Centre, namely :

4. NATIONAL INSTITUTE FOR CHEMISTRY
5. NATIONAL INSTITUTE FOR PHYSICS
6. NATIONAL INSTITUTE FOR METALLURGY
7. NATIONAL INSTITUTE FOR ELECTROTECHNIQUES and
8. NATIONAL INSTITUTE FOR INSTRUMENTATION. In June 1983 this institute moved to Serpong, Tangerang.

This grouping, which is primarily administrative in nature, is carried out upon the following considerations :

a. By this grouping the related institutes are exempted from administrative affairs, so that they are able to concentrate their attention to scientific tasks;

b. These institutes are situated in Bandung and Serpong, conducting technological research in their fields; each performs tasks supplementary to the tasks of the other institutes.

9. THE NATIONAL INSTITUTE FOR ECONOMIC AND SOCIAL RESEARCH

The Institute conducts research in economic and social fields in general with the aim of obtaining materials and data needed in planning Indonesia's economic development and population development.

In addition, the Institute is sometimes given an ad hoc task to give advice on problems that require immediate solution.

10. THE NATIONAL INSTITUTE FOR CULTURAL STUDIES

This Institute performs research in two fields :

a. In the first field, research is conducted on the view of life and the cultural values held by Indonesian ethnic groups, primarily within the framework of Indonesia's national development.

b. In the second field, research is conducted on the cultural aspects of other nations, particularly our neighbouring nations and nations which are undergoing the process of development, in order that the knowledge acquired can be applied in cooperation and relations with the nations concerned.

In conducting research in the Provinces, the National Institute for Economic and Social Research and the National Institute for Cultural Studies have close cooperation with the local universities, by having lecturers and students participate in research projects in the respective regions.

Ad. II. ASSISTING THE GOVERNMENT IN THE PLANNING OF NATIONAL SCIENCE POLICY'

As in other fields, the government should have a National Science Policy. This policy has two principles, namely :

a. to develop the manpower.and facilities in the field of science which are needed to undertake research for the benefit of the government and people in particular and of mankind in general.

b. to utilize the achievements of science and technology for national development.

It is necessary to formulate a national science policy which includes the necessity to have accurate knowledge concerning the state of manpower, facilities etc. at the research institutes. Therefore, LIPI conducted a survey on these matters, However, the materials obtained from this survey have to be updated, and these should be continual checking.

In the attempts of " planning for science " and "planning for the use of science", it is a prerequisite to know the programmes of the Government in general or the programmes and research planning of the Departments in particular; furthermore, skills in various fields of science are needed. With regard to this, LIPI has to consult the representatives of the Departments and also the experts in several fields of science from the Departments : and outside the Departments in order to formulate a science plan and a plan for the use of science.

Ad. III ACTING AS ADVISER TO THE GOVERNMENT BODIES ON MATTERS RELATING TO SCIENCE.

In its position as the builder of science, LIPI either upon request or at its own will, should be ready to give considerations/recommendations on matters relating to science and its function in society.

Certainly, the capability of the Staff of LIPI is limited and doesn't cover all fields of science. Therefore LIPI must utilize the skills found at universities etc.

Relating to this, in order to fulfil its tasks, LIPI should set up Ad Hoc Committees covering various fields of science, in accordance with the problems faced by LIPI which require urgent solution.

Ad. IV UNDERTAKING COORDINATION, INTEGRATION AND SYNCHRONIZATION IN THE FIELD OF SCIENCE AND TECHNOLOGY AT THE CENTRAL AND REGIONAL LEVELS.

Since its establishment, LIPI based on Article 5 of the Presidential Decree No. 128/1967 has performed activities in the field of coordination. These attempts are under taken at the technical level.

At the administrative and organizational level LIPI carries out the activities of coordinating the research bodies of the Departments entrusted with the task of developing research effort in the Departments concerned. At the technical level there are various bodies, set up before the establishment of LIPI, that coordinate the research in certain fields of science.

Ad. V BUILDING UP OR PARTICIPATING IN THE BUILDING UP OF POTENCY IN THE FIELD OF SCIENCE AND TECHNOLOGY.

The development of the science and technology of a nation is determined by research activities, qualitatively and quantitatively.

A principal element in this matter is the research worker. Valuable research can only be conducted by qualified research workers, while to obtain an obvious impact on national development, research has to be conducted by a sufficient number of research workers. Owing to this, the building up of scientific manpower plays an important and decisive role.

The implementation of this building up of manpower should constitute an effort of cooperation among the various governmant bodies concerned. This task of strengthening the manpower, includes not only education, but also the efforts to improve the social and material position of the research workers, and to give appreciation

of their achievements in developing science and technology.

Furthermore, on the basis of agreement between LIPI and the Office for Personnel Affairs, LIPI has set up a committee of experts with the task of assisting LIPI leadership in evaluating the achievements of the research workers and promoting them to a special grade and position.

Another aspect in the building up of ability in the field of science and technology is the provision of facilities and funds in order that a good research can be produced. This is conducted by the government bodies concerned, but it would be better if all the matters were implemented according to "a science plan".

The third aspect is the communication and dissemination of information in the field of science and technology. This is necessary both for scientists and for those who need information for development work.

The National Scientific Documentation Centre plays an important role in the task of providing information. Each research worker who needs literature for his research can obtain it with the help of the Documentation Centre in the form of a photocopy, microfilm etc.; if the literature is to be found in Indonesia, he can be provided with it in a short time, but it is not available here, the Documentation Centre can obtain it through the services rendered by documentation centres abroad. For the industrial group the National Scientific Documentation Centre provides technical information.

It is worthy of note that in giving information and presenting the results of research conducted by the Research Staff of LIPI, this Institute is publishing *Berita Ilmu Pengetahuan dan Teknologi, Sari Karangan Indonesia, Masyarakat Indonesia, Bulletin LIPI* (Index of Indonesian Learned Periodicals), *Baca, Annales Bogorienses, Pewarta Lembaga Biologi Nasional, Bio Indonesia, Alam Kita, Reinwarditia, Treubia, Bulletin Kebun Raya, Penelitian Laut di Indonesia* (Marine Research in Indonesia), *Oseanologi Di Indonesia, Pewarta Oseana, Oceanographical Cruise Report, Bulletin of the National Institute of Geology and Mining, Teknologi Indonesia, Telaah, Instrumentasi, Riset Geologi dan Pertambangan,*

LEN Technical Journal, Masalah-Masalah Internasional Masa Kini, monographs and occasional papers of the research institute of LIPI.

ad. VI. IMPLEMENTING OR ASSISTING IN CARRYING OUT THE APPLICATION OF SCIENCE AND TECHNOLOGY FOR DEVELOPMENT.

Science has no significant value if it is not applied for increasing productivity which will raise the standard of living of the people. The utilization of existing knowledge in the fields of science and technology – whether the science is imported from abroad or developed in Indonesia – is absolutely important for the development of the country. In this connection, at present particularly the results of domestic research have not been sufficiently developed to produce new produces or new processes, or to improve existing products or existing processes. In 1971/1972 LIPI will continue in its endeavours to utilize science and technology which had been started in 1970/1971.

Ad. VII. EFFORTS TO INCREASE PUBLIC UNDERSTANDING OF THE ROLE OF SCIENCE AND TECHNOLOGY IN NATIONAL DEVELOPMENT.

Science and its application in a country cannot develop, if it is only applied by the scientists and scholars without the understanding and support of the public. Gradually, Indonesia has to create a situation in which science is integrated into the culture of the society. To achieve this goal, LIPI is conducting and has conducted several activities, such as giving scientific information through T.V. and radio, organizing or assisting in the holding of scientific exhibitions, publishing or assisting in the publishing of popular scientific publication,s encouraging the establishment and guiding the development of Science Clubs among young people, etc.

Ad. VIII. CARRYING OUT SCIENTIFIC ACTIVITIES AT THE REGIONAL AND INTERNATIONAL LEVELS.

As an inheritance of the institutions attached to LIPI during its establishment, the Institute represents Indonesia at 11 non-governmental international scientific institutions:

1. International Council of Scientific Unions (ICSU)
2. International Geographical Union (IGU)
3. International Union of Geodesy and Geophysics (UGGI)
4. International Federation of Documentation (FID)
5. Special Committee on Oceanic Research (SCOR)
6. Committee on Space Research (COSPAR)
7. Special Committee for the International Biological Programme (SCIBP)
8. Pacific Science Association (PSA)
9. International Electrical Commission (IEC)
10. International Organization for Standardization (ISO)
11. World Association for Industrial and Technological Research Organization (WAITRO)

LIPI LEADERSHIP

The Chairman of LIPI	: D.A. Tisna Amidjaja
Deputy Chairman for Natural Sciences	: Didin S. Sastrapradja
Deputy Chairman for Technology	: Muhammadi Siswo Sudarmo
Deputy Chairman for Social Sciences and Humanities	: Mochtar Buchori
Secretary	: S. Simamora

DIRECTORS OF THE INSTITUTES

National Biological Institute	: Setijati Sastrapradja
National Institute of Oceanology	: Aprilani Soegiarto
National Institute of Geology and Mining	: Sismarjanto Sadarjoen
National Institute for Physics	: Arjuno Brojonegoro
National Institute for Chemistry	: Ign. Suharto
National Institute for Electrotechniques	: Sumarjoto Kajatmo
National Institute for Instrumentation	: Herudi Kartowisastro
National Institute for Metallurgy	: Djuwito Atmowidjojo
National Scientific Documentation Centre	: Luwarsih Pringgoadisurjo
National Institute for Economic and Social Research	: Suharso
National Institute for Cultural Studies	: Alfian

HEADS OF BUREAUS AND SECRETARIAT

Bureau of Co-ordination and Science Policy	: **Nilyardi Kahar**
Bureau of International Relations	: Moertini Atmowidjojo
Bureau of Public Relations	: Soedito
Bureau of Legal Affairs and Patents	: Mrs. Diti K. Gunawi
Bureau of Finance	: Sukotjo Christina Muljono
Bureau of Logistics	: H.W. Tampubolon
Bureau of Control	: Mgs. A.H. Komaruddin
Bureau of Scientific Publications	: Tukidjan Kusumoputro
Bureau of Construction	: Rio Rachwartono
Bureau of Personnel	: L.S. Sihombing
Secretariat	: Rio Rachwartono

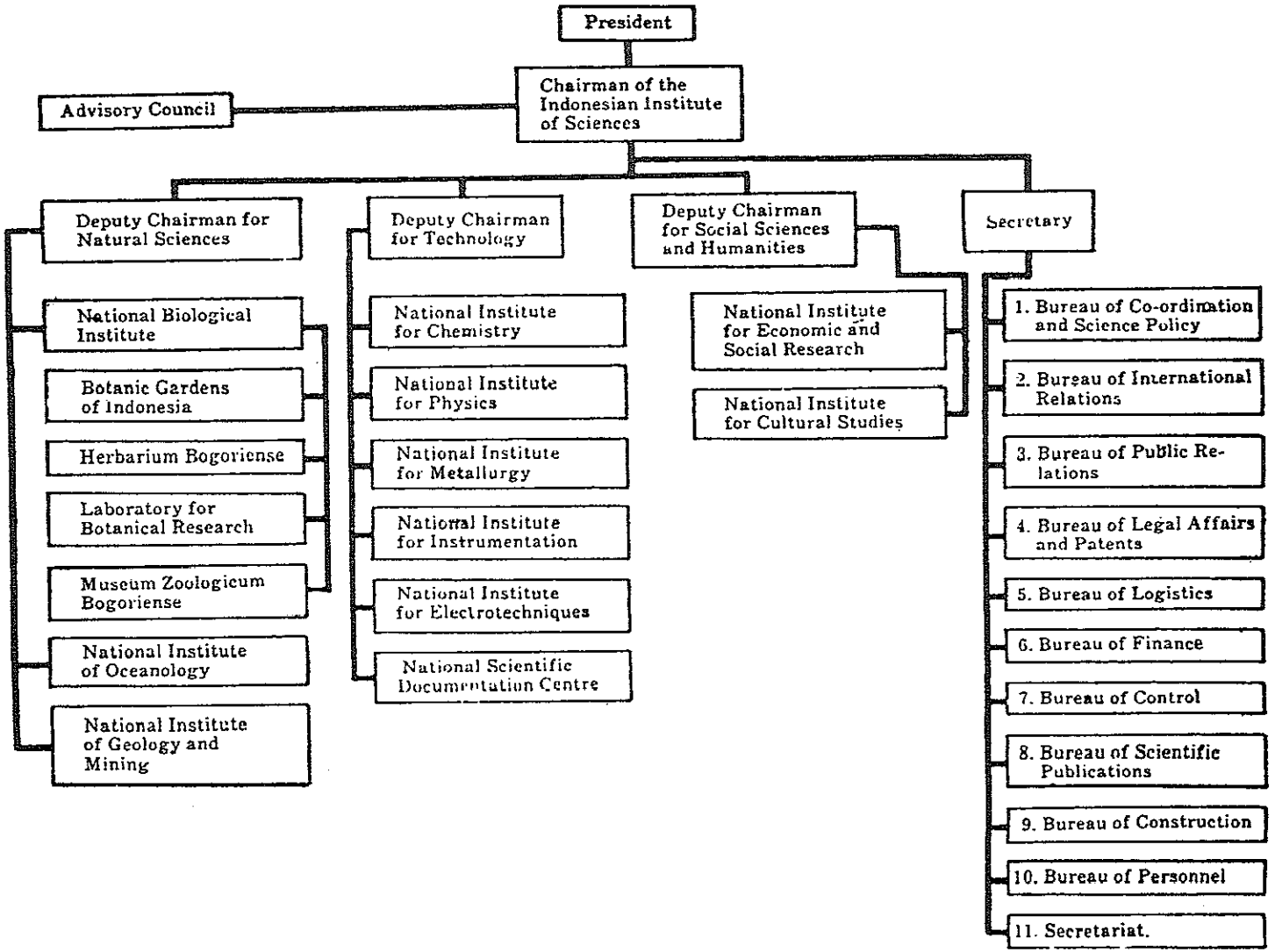
ADVISORY COUNCIL OF LIPI

Chairman	: Thojib Hadiwidjaja
Member	: Umar Seno Adji
Member	: Widjojo Nitisastro
Member	: G.A. Siwabessy (†)
Member	: Kuntoadji
Member	: Baiquni
Member	: K. Djaelani

＜ 資　料　3 ＞

国家科学技術院（ＬＩＰＩ）紹介用パンフレット

INDONESIAN INSTITUTE OF SCIENCES (LIPI)



LIBRARIES OF LIPI

NATIONAL SCIENTIFIC DOCUMENTATION CENTRE

Address : Jl. Jen. Gatot Subroto, Jakarta Selatan
Phone : 511063 - 583465
Covers the natural sciences and technology.

NATIONAL INSTITUTE FOR ECONOMIC AND SOCIAL RESEARCH

Address . Jl. Jen. Gatot Subroto, Jakarta Selatan
Phone : 511546
Covers the fields of economic, social and political sciences.

NATIONAL INSTITUTE FOR CULTURAL STUDIES

Address : Jl. Jen Gatot Subroto, Jakarta Selatan
Phone : 511546
Covers the fields of culture and humanities.

THE CENTRAL LIBRARY OF LIPI

Address : Jl. Cisitu/Sangkuriang, Bandung
Covers the fields of physics, chemistry, geology and mining, metallurgy and instrumentation.

LIST OF ADDRESSES OF LIPI AND ITS RESEARCH INSTITUTES

1. Indonesian Institute of Sciences – LIPI, (Central Office)
   Address : Jl. Jen. Gatot Subroto, Jakarta Selatan
   Phone : 511542, 511546, 512098, 512359
   512109

2. National Biological Institute.
   Jl. Ir. H. Juanda, Bogor
   Phone : 21038, 21039, 21040, 21041.

3. National Institute of Oceanology.
   Kompleks Bina Samudera
   1, Jl. Pasir Putih, Ancol Timur, Jakarta
   Phone : 683850, 680859, 681948.

4. National Institute of Geology and Mining
   Jl. Sangkuriang, Bandung
   Phone : 81054

5. National Institute for Chemistry
   Jl. Sangkuriang, Bandung
   Phone : 81051

6. National Institute for Physics
   Jl. Sangkuriang, Bandung
   Phone . 81052

7. National Institute for Metallurgy
   Jl. Sangkuriang, Bandung
   Phone : 51952

8. National Institute for Instrumentation
   Kompleks PUSPIPTEK, Serpong, Tangerang
   Phone : 515248

9. National Institute for Electrotechniques
   14, Jl. Sawunggaling, Bandung
   Phone : 51515

10. National Institute for Economic and Social Research
    Jl. Jen. Gatot Subroto, Jakarta Selatan
    Phone : 511542, 511546

11. National Institute for Cultural Studies
    Jl. Jen. Gatot Subroto, Jakarta Selatan
    Phone : 511542, 511546

12. National Scientific Documentation Centre
    Jl. Jen. Gatot Subroto, Jakarta Selatan
    Phone : 511063, 583465

＜ 資　　料　　4 ＞

国立冶金研究所（LMN）紹介用パンフレット

NATIONAL INSTITUTE FOR METALLURGY (NIM)

The National Institute for Metallurgy (Lembaga Metallurgi Nasional) is an Indonesian Government's Research Institution under The Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia – LIPI).

The Institute has been established for carrying out R&D works on indigenous ores, mineral and metals, so as to make the best and optimal use of the country's mineral welath. It covers a broad range of research activities starting from the proper utilization of indigeneous raw materials up to the development and preservation of the products. The institute also provides scientific and technical information services to public, industries, and goverment in the field of metallurgy.

BRIEF HISTORY

National Institute for Metallurgy – LIPI was established in 1965 and it was one of the research institutions under Indonesian Science Council (MIPI).

In 1967 Indonesian Science Counsil was re-organized to the Indonesian of Sciences (LIPI). LMN was transferred to LIPI.

BACKGROUND INFORMATION

Mineral resources of Indonesia contitute one of its most valuable and strategic assets that can be utilized as one of the basic element for overall economic development. Most of the mineral deposits now being developed in this country are exported as raw materials, mean while Indonesia imports various kind of basic materials (metals, alloys, compounds etc.) needed by industries, which is fact can be produced from indigenous raw material.

The present government policy on natural resources development is to force the upgrading or processing of the mineral wealth to the maximum extent possible domestically, that will effect:

- increasing foreign exchange earning
- stimulate regional development
- creation of new employment opportunities, and attracting national investment
- supply basic material for indigenous industries.

To realize these programmes, the development of national capabilities in mineral science and technology will be one of the most decisive key factor.

Mean while, the management of these resources needs a comprehensive study on the deposits, the process technology, and the economic factors involve, e.g.: supply and demand, cost and price, etc. These factors become more important if the minerals and products will be sold as export commodities.

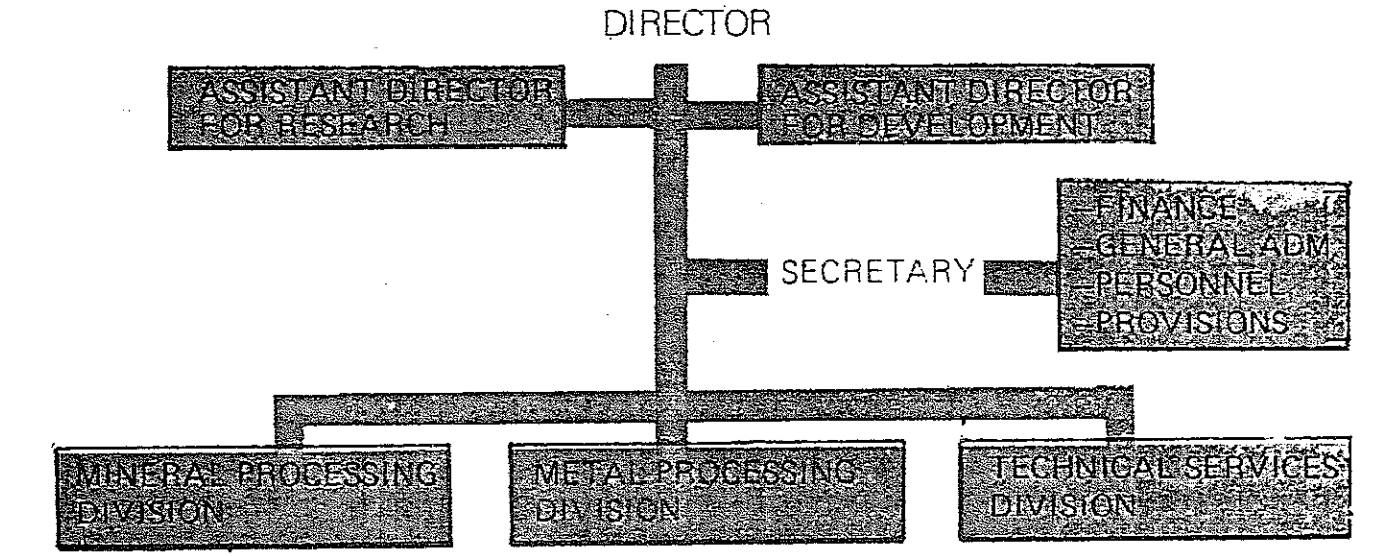
However, the main use of Indonesian mineral wealth should be directed to meet domestic demand, and to improve the prosperity of its citizen. Because of the majority

of Indonesian people live in countrysides, development of such areas needs a greater attention. One of the most important aspect of rural development is the utilization of indigenous resources to meet their basic needs: food, housing and clothing. The resources should be used also to improve their infrastructure, health and education.
Because of technological problems, the role of mineral resources for these purposes is still very limited. A challenge for National Research Institute for Metallurgy to solve the problems by developing appropriate technology in the mineral processing field.

Beside the mineral processing, NIM also concerns with metals usage and conservation. The use and demand of structural metals in Indonesia are steadily increasing year by year. As a consequence, conservation problems in general and maintenance problem in particular become very serious problems. Metals deteriorization that is caused by corrosion is one of the most important aspect of metals conservation. Really, corrosion cost not only money, but also material, safety and the continuity of operation. In financial term, a group of corrosion experts make an estimate that Indonesian lost of corrosion now cost about $ 200 millions a year. Corrosion protection should be handled and treated by an integral approach, from the designing stage, the construction stage up to the operation stage and maintenance. For that purpose, people should learn and understand the basic corrosion principle and protection, and receive enough information about the evironment, the material used and the most appropriate methods of corrosion protection. In this framework, NIM'S develops a corrosion group which is expected to handle the problems effectively.

ORGANIZATION & DIRECTORSHIP

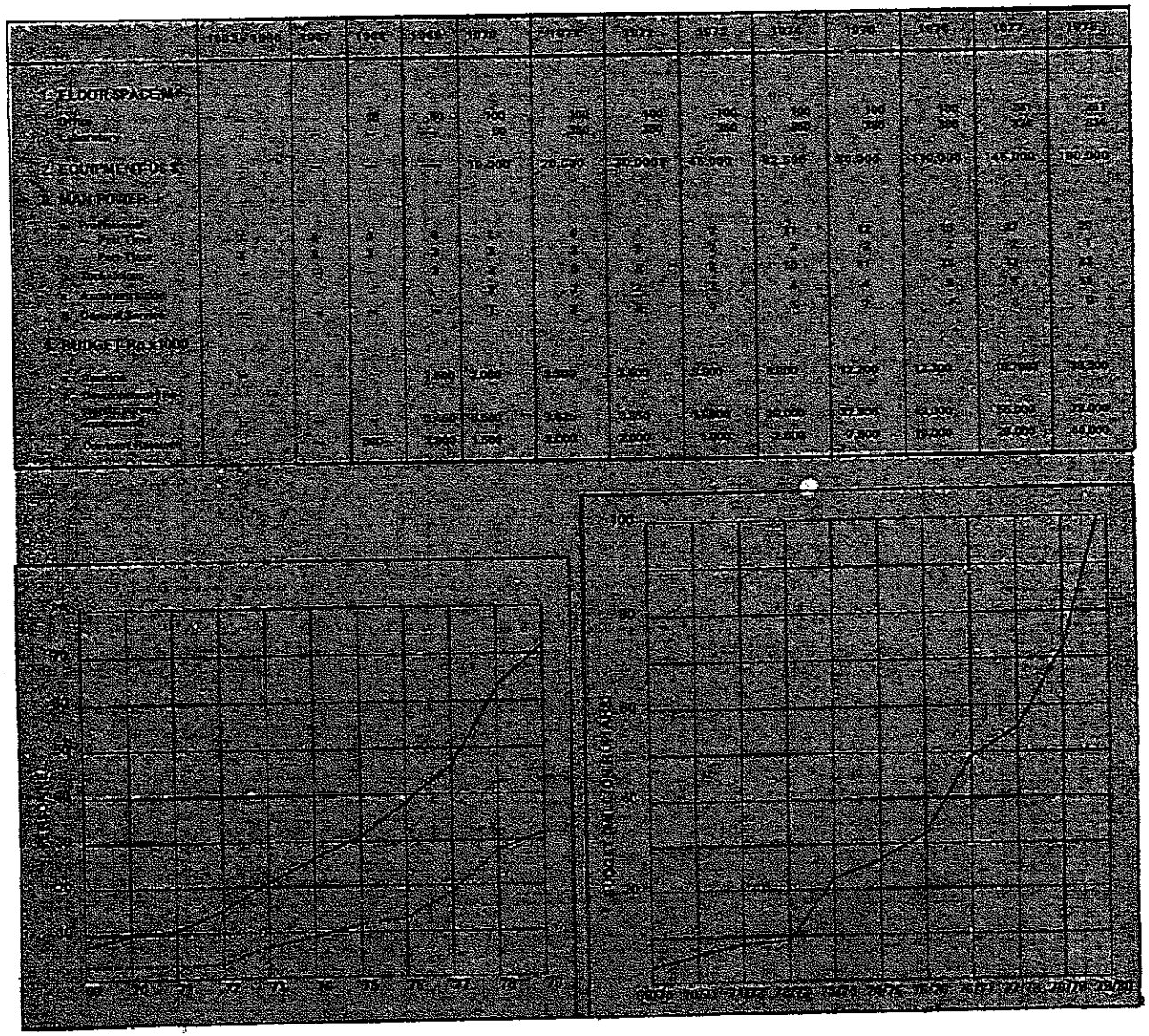
ORGANIZATION



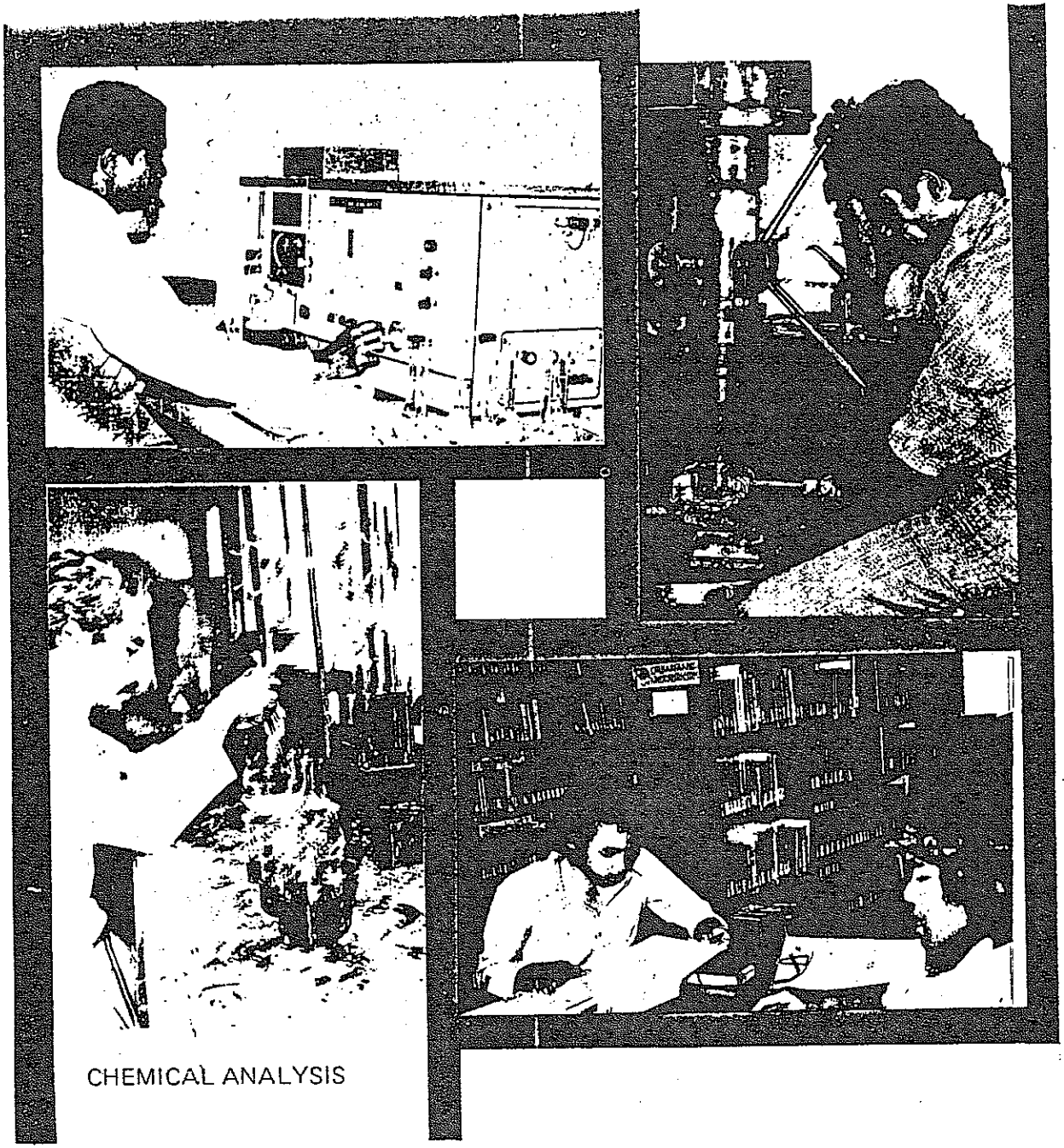
DIRECTORSHIP

DIRECTOR	:	Djoewito Atmowidjojo
Ass. Dir. for Research	:	Sukarna Djaja
Ass. Dir. for Development	:	A. Sulaiman

PROGRESS



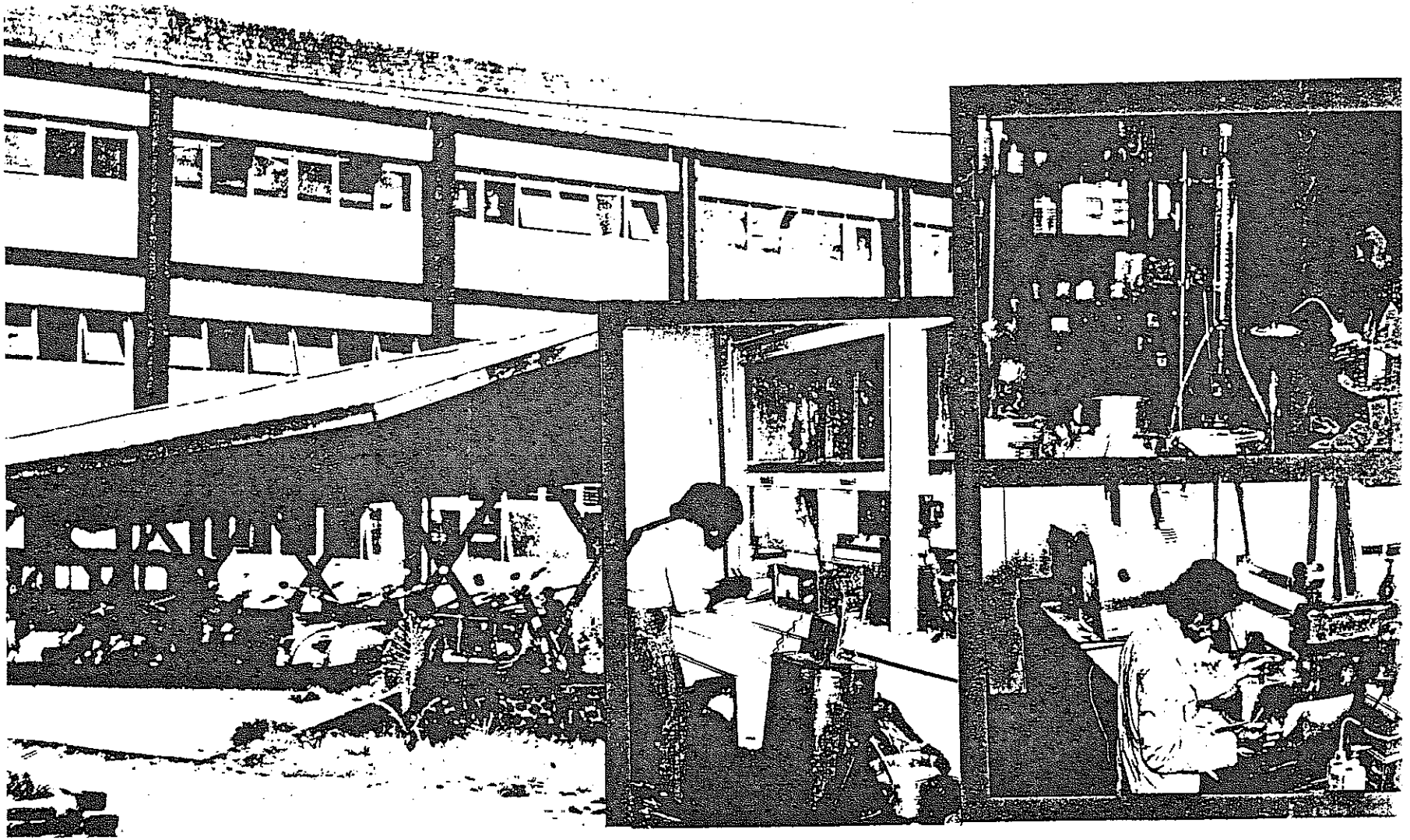
GENERAL FACILITIES



CHEMICAL ANALYSIS

WORKSHOP

LIBRARY



MINERAL RESEARCH ACTIVITIES

BACKGROUND: NIM'S LABORATORY BUILDING
(3 rd FLOOR)

FIELD OF ACTIVITIES

The research activities of the National Institute for Metallurgy can be divided mainly on two general fields which are represented by the two divisions of the institute:

A. The Mineral Processing Division.

B. The Metal Processing Division.

MINERAL PROCESSING DIVISION

The Mineral Processing Division concentrates its activities on the beneficiation and processing of Indonesian mineral wealth to produce metals and other valuable products. Three main problem areas are handled by this division:

1. **The Low Grade Ores.**

   This is a very strategic problem in the utilization of Indonesian mineral wealth, espescially with the low grade bauxites and the iron-nickel laterites. Being a low grade in nature, the deposits can not be develaoped to became valuable export commodities because they will need a high cost of handling and transportation. The only choice is to process the ores domestically. However, also in this case the ores present a great deal of problems technically as well as economically.

   It is quite clear, that this problem is not an easy one, espescially for Indonesia with its limited experience and technological infra structure. However, the problem is too strategic to be overlooked.

   So the NIM try to collect all of its courage to start tackling the problem in its long term program. It is expected that in 10-20 years to come, NIM efforts in this field can give some fruitful results.

2. **The small Mineral Deposits.**

This problem arise because of the fact that Indonesian mineral deposits are usually found as small and scattered deposits. This kind of deposits can not be processed by the existing technology which is developed for large processing plants. The same challenging and interesting problem as with the low grade ores, the small deposits problem can be solved more readily and completely by the resources available in the National Institute for Metallurgy. It is because that the expected prcesses are cheap and simple, the research and development are still possible to be done by the limited budget available.

In a financial term, the problem of small mineral deposits can not be considered as a strategic problem. However, some interesting results can be expected, if the problem can be solved:

* creation of new employment opportunities
* stimulation of regional development
* strengthening the domestic industrial network.

Results which are too valuable to be seen in a financial term only.

3. **The Mining and Industrial Wastes.**

The mining and metal industries produce many kind of wastes which need to be utilized, e.g.: ilmenite from tin washery, zinc waste from galvanization industries, industrial scrap of tin-plate, lead scrap and many others. The ilmenite from tin washery, zinc waste from galvanization industries, industrial scrap of tin-plate, lead scrap and many others. The ilmenite from tin washeries in Banka and Billiton has a quite great potential to be used as a raw material for TiO_2 pigment, which is widely used in paint, paper, textile and rubber industries. Zinc waste from galvanization industries (zinc dross, ash and dust) also has a good potential to be processed to zinc metal and oxide. So do the other scraps and wastes from industries, such as lead scrap, iron scrap and others.

Some of the wastes can be processed by a very simple technique which can be done in a backyard industry, the kind of industry which is very suitable to combat unemployment

METAL PROCESSING DIVISION

The Metal Processing Division concerns with processing development and conservation of metals. Three main fields are developed in this division:

1. **Corrosion.**

   The NIM handles Indonesian corrosion problems through researth activities, cooperative works with other intersting bodies, dissemination of information and consultation. Immediate but systematic actions to combat Corrosion in Indonesia are needed to give protection and assurance of its development programmes. The increasing use of iron and steel, and the corrosive environment of this tropical region makes the corrosion problems more and more challenging.

   The typical marine environment combined with hot and humid tropical weather, is in fact the main cause of corrosion to all metals exposed. The huge amount of metals, which has been used for various purposes such as in the transportation system, industries, structures for both inland and offshore, scientific equipment, etc. are therefore subject to the danger of corrosion. The amount of money spent for preventive measures, e.g. plating, painting, replacement of corroded parts, use of special alloys etc. is extremely high. Estimates of this sum for Indonesia go as high as high as about 200 million dollars in 1977, a terrible waste of money and natural resources.

   With such challenging problems, NIM choses corrosion as one of its core activities.

2. **Surface treatment.**

3. **Alloy development.**

   Government policy to force domestic production of automotive components will creastes problems in the fields of surface treatment and alloy development. Up to now, surface treatment in this country are used only to improve the appearance. But in component productions, the technical performance will became a more dominant factor. The same problems will also arise in the field of alloy development. However, NIM group in these fields have not developed because of the limited budget and manpower.

CURRENT RESEARCH ACTIVITIES

Due to the limited resources available at NIM-LIPI (research staffs, equipment etc.), a list of priority areas has been set up, based on various aspects, namely: the availability of ores, potencial demand of products, technological aspect, social and economic aspects etc.

The research and development programme for the 3rd Five Years Development Plan, will cover the following projects.

1. **Project on Base Metal** (Lead, Zinc and Copper),

   There is an increasing demand of these metals and its alloys and compound. Import of these metals in 1976 are 42.000 tons for Zinc, 12,000 tons for Lead and 30,000 tons for Copper.

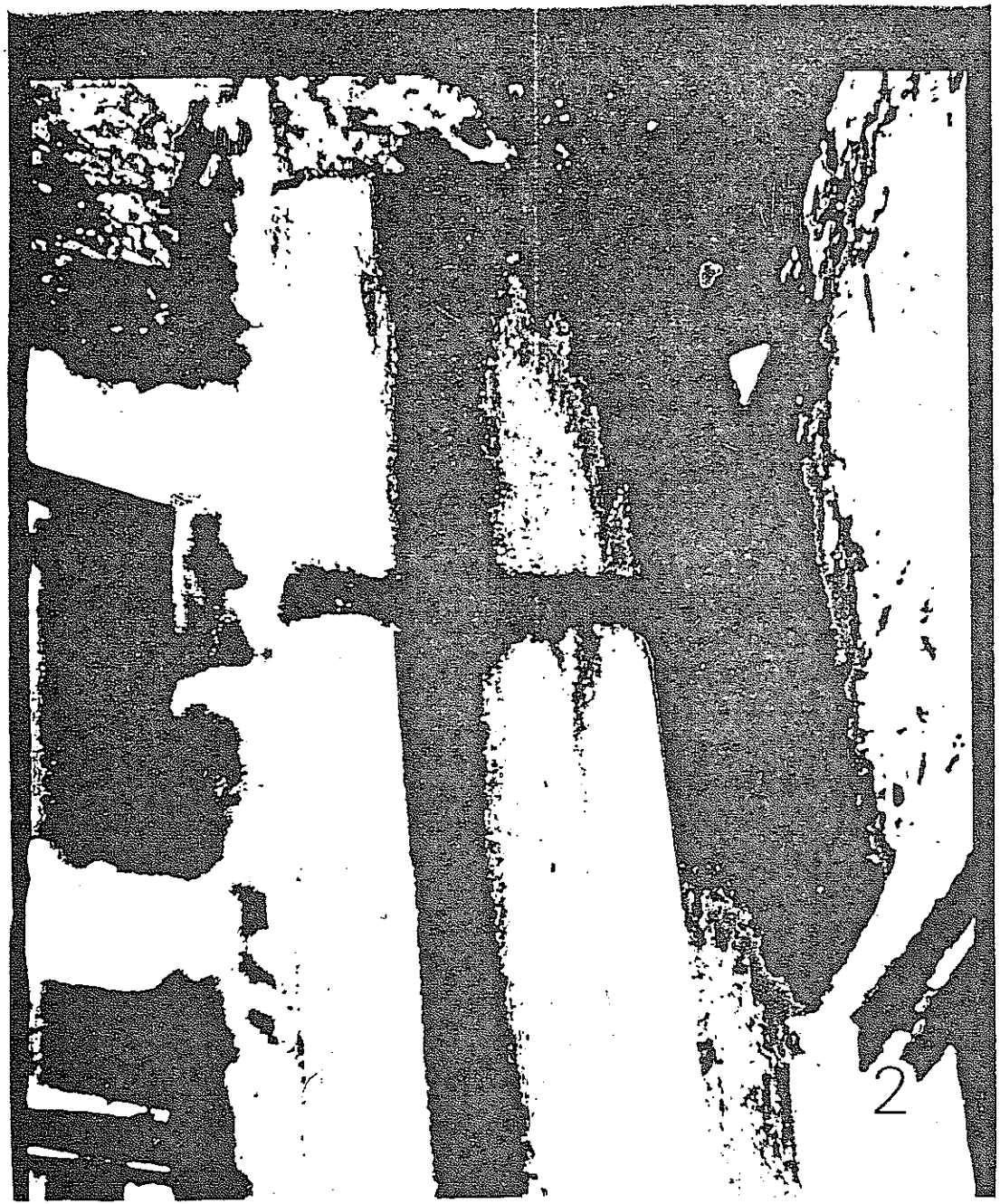
   Potential ores are found in various places in Java, Sumatra, Sulawesi, Nusa Tenggara, atc. The type of ores are mostly small but high grade, sporadic and scattered. At present mining and beneficiation plant for lead and zinc have been established in Cikotok.

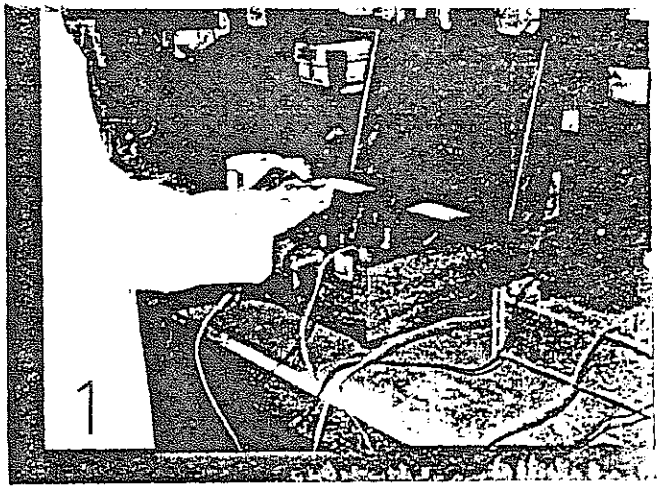
   Other deposits are being explored to examine the size of ore deposits. Small smelting plant with six tons lead capacity for Lead Blast Furnace have been established by PT Aneka Tambang. The Lead Blast Furnace and other equipment in this smalter have been designed, constructed and dupervized by NIM. It is planning to expand with zinc processing in the near future where NIM will also be involved in this project. Research and development for the improvement of lead semelting performance, and the selection of the suitable process for zonc is being undertaken by NIM.

2. **Project on Manganese.**

   Manganese ore (Pyrolusite) are found in Java Island, Timor Island, Doi Island, South Sumatra, etc.

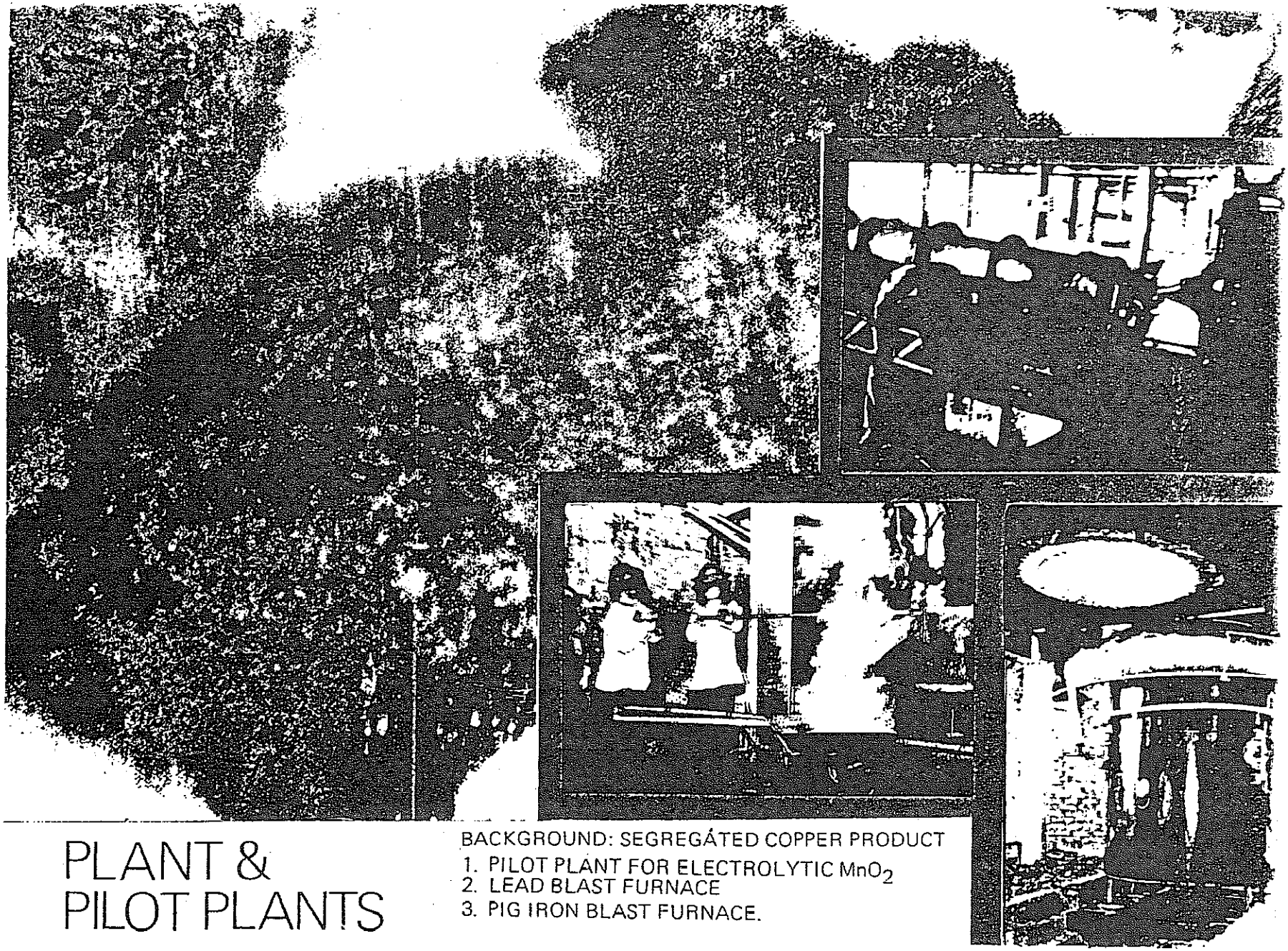
   Instead of buying local high grade Manganese ores, the Indonesian battery industries





CORROSION

1. SOIL RESISTIVITY TESTING
2. CORROSION IN A WATER TOWER OF INDONESIAN BONDED WAREHOUSE.



PLANT & PILOT PLANTS

BACKGROUND: SEGREGÁTED COPPER PRODUCT

1. PILOT PLANT FOR ELECTROLYTIC MnO_2
2. LEAD BLAST FURNACE
3. PIG IRON BLAST FURNACE.

still import at least 4000 tons of Electrolytic Manganese Dioxide (EMD) which local market price of EMD is about $ 900.- per ton.
In the near future Indonesia also need ferro manganese for the steel plant.
Research activities have been carried out by NIM among others to investigate the possibilities of producing EMD and other manganese compound, such as ferro manganese.

3. **Project on Processing of Jarosite.**

A Considerable deposit of Jarosite about 1 million ton are found in Ciater district, 40 km to the north of Bandung.
Mineral Jarosite contains several valuable constituents such as iron oxide, potassium, phosphate and SO_3 which can be processed to produced iron oxide pigment, potassium fertilizer, phosphate and sulphuric acid.
Iron oxide pigment is consumed by paint industries with the estimate annual consumption 5000 ton or US $ 8 million, imported from Germany.
Potassium and Phosphate fertilizer in a big amount are needed by agricultural sectors with the local market price of about US $ 2000.- per ton.
Since 1978 NIM started to evaluate the Jarosite deposit, and made a research programme with the purpose of developing the technology suitable for small secale operation.

4. **Project on Foundry Pig Iron Making.**

The demand of foundry pig iron in Indonesia is steadily increasing year by year. Starting as low as 7,500 tons in 1971 reach 25,000 tons in 1975 and projected to become more than 60.000 tons in 1980. The supply of this commodity is still imported. On the other hand Indonesia has more than 1 million ton of iron ores in South Sumatra and South East Kalimantan which contains more than 56% Fe. With billion tons of coal found in South East Kalimantan, South Sumatra and West Sumantra, the iron ores can be reduced to produce pig iron needed.
However, the coal should be converted first to metallurgical coke before it's used as a blast furnace fuel.

Because of the rather advance technology needed to make the coke, charcoal which is available as by product of forest exploitation can be considered to replace the cokes The smelting test of the ores have been done in a small blast furnace using imported cokes as fuel.

The blast furnace is specifically designed for reseach purposes, with swing bottom mechanism. In case of trouble, the hearth can be moved and repaired with out breaking the whole structure up.

The use of charcoal as fuel has been tried but still making a lot of trouble, because of the low content of fixed carbon in it. Selection of better kind of charcoal and development of suitable cokes for the blastfurnace will become NIM'S programme in the near future.

5. **Project on Beneficiation of Acid Bearing Water from Ijen Crater (East Java).**

The crater lake of kawah Ijen East Java, contains about 40 million m^3 of strongly acid water. The main chemical constituents of this acid water are: SO_3, Cl-,Fe_2,O_3, K_2O, etc.

From this crater, about 0.5 million m^3 can be tapped annually without any danger. From the acid water as mention above, varieties of chemical products can be obtained among other chloric acid, alum, gypsum, fertilizer, atc.

Domestic demand for chemical products are quite big. For example, gypsum for cement industries is imported around 200.000 ton annually(based on Gypsum consumption for cement industries about 3-4% of product). Annual capacity of established cement plant in Indonesia at present is 5-6 million ton.

Laboratory scale investigation for producing gypsum have been carried out by NIM'S research group succesfully. It is intended to proceed with the development work, for being able to make an aconomic evaluation.

6. **Exploratory Works on Lateritic Nickel and Bauxites.**

Some processes to treat lateritic nickel and bauxites had been investigated in NIM's laboratories. For lateritic nickel, process investigation had been stressed on the hydrometallurgical processes and segregation. It is hoped thatthe process will need

less energy than the other existing processes, so it is still economical to teat the low grade lateritic nickel ores.

The problems of low grade bauxites is quite different. Is not so influenced by the energy consumption, the low grade bauxites have a problems with reactive silicates which consumes NaOH and hinders the dissolution of alumina in conventional Bayer process. National Institute for Metallurgy try to solve the problem with the lime soda sinter process.

7. **Corrosion.**

The institute's research activities in the field of corrosion are concentrated in two general activities:

a. Environmental stùdies
b. Corrosion protection.

The evironmental studies intend to detect and measure the amount of corrosive component of Indonesian atmosphere in some selected locations. These studies will give environmental data which are very helpful in chosing the correct material and design during the planning stage, and then developing the right system for its prevention and protection against corrosion. The research activities on corrosion protection are directed to develop suitable protection methods to combat Indonesian corrosion problems. Two of the most common methods are investigated, namely: cathodic protection and coating.

Besides of its research activities, NIM's corrosion group is forced to solve so many immediate field problems, for examples:

a. Corrosion problems in The Indonesian Bonded Warehouses. These central state owned warehauses are challenged by corrosion problems of its buildings, transportation system and fire protection system.
b. Corrosion problems of marine transportation system, public works and industries.
c. Cathodic protection design for pipe installation of the State Gas Company.

To Solve these practical problems, NIM cooperates with other (government and privates) interesting bodiea in a professional organization: Indonesian Corrosion Association (INDOCOR).

COOPERATION

The National Institute for Metallurgy has an intimate cooperation with domestic and international R&D institutions, universities, and companies.

Domestic Cooperation

1. R&D institutions : Material Testing Institute, Mineral Technology Development Centre, Metals Industries Development Centre, and R&D institutions under LIPI.
2. Universities : ITB (Bandung Institute of Technology), and The Technical Faculty University of Indonesia.
3. Government and private institutions and companies : Ministry of Industies, Ministry of Mining and Energy, Ministry of Public Work, PT Aneka Tambang (State owned General Mining Company), PT Timah (State Tin Company), State Dockyard Co., PT Bonded Werehouse Indonesia, State Gas Co., State Petrochemical Co., etc.

International Cooperation

1. Informal cooperation with universities and R&D institutions : University of New South Wales (Australia), University of Kyoto (Japan), National Institute for Pollution and Resources (Japan), National Metallurgical Laboratory (India), Cebelcor (Belgium), NACE (USA), Laboratoire du Tropicalization (France), Research and Productivity Council (Canada), and private communications between research workers.
2. Formal cooperation still under exploration, with :

   France goverment : in the field of Corrosion.
   Australian goverment : in the field of Extractive Metallurgy.
   CIDA – Canada : to develop small mineral processing plants.
   JICA – Japan : in lateritic research.
   JSPS – Japan : on Man Power Development.

OTHER ACTIVITIES

SEMINARS, SCIENTIFIC MEETINGS, UPGRADING COURSES
PUBLICATIONS:
- METALLURGY (BULLETIN OF EXTRACTIVE METALLURGY)
- KOROSI(BULLETIN OF CORROSION)
- SCIENTIFIC REPORTS
- ANÑUAL REPORTS