

**パプア・ニューギニア  
鉱業分野（人材育成）プロジェクト  
基礎調査団報告書**

2000年5月

**国際協力事業団**

## 序 文

パプア・ニューギニアは、1975年に独立した開発途上の新興国です。同国は銅、金、石油などの天然資源に恵まれ、これらの生産はGDPの約25%、総輸出金額の約70%（1998年）を占める鉱産国であり、資源開発が同国の経済に占める比重は極めて大きくなっています。

しかしながら、鉱業生産は少数の大鉱山と少数の鉱産物品目に依存しているのが現状です。また、金価格の低下による投資意欲の減退及びパプア・ニューギニア政府の行政手続きの遅れによる鉱区権付与の遅延等のため、鉱物資源開発は停滞しています。

また、大規模な鉱山開発による環境問題が顕在化してきており、パプア・ニューギニア政府は「中期開発戦略」（1997～2002年）において「天然資源開発と環境保護を両立しつつ次世代への恩恵を考慮した発展」を掲げています。こうしたことから、鉱業分野への開発については、環境保全と両立した持続可能な開発への協力が必要になっています。

このような背景の下、パプア・ニューギニアにおける鉱業の現況を把握するとともに、同国への援助重点分野である「環境資源の保全と持続的な利用・開発」に沿って、「天然資源の持続的開発及び鉱害防止を含む環境保全への支援」を念頭に、プロジェクト方式技術協力の実施の妥当性・可能性を確認するため、2000年4月に基礎調査団を派遣しました。本報告書は、同調査団の調査結果を取りまとめたものです。

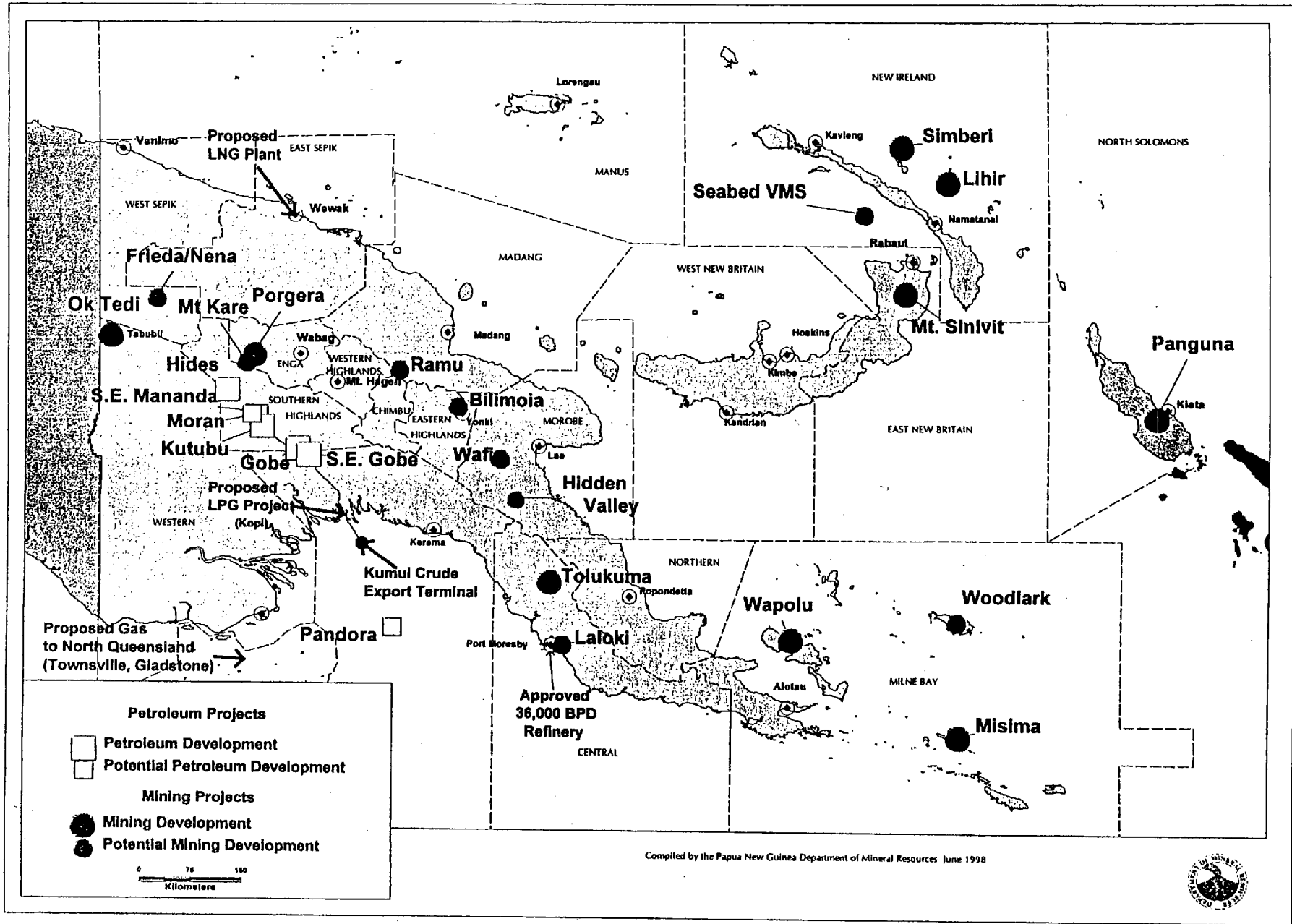
ここに、本調査団の派遣にあたりご協力をいただいた日本及びパプア・ニューギニアの関係各位に対し、深甚なる謝意を表するとともに、あわせて今後のご支援をお願いする次第です。

2000年5月

**国際協力事業団**

**鉱工業開発協力部**

**部長 林 典伸**



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# 第 1 章 基礎調査団の派遣

## 1 - 1 調査団派遣の経緯と目的

### (1) 調査団派遣の経緯

パプア・ニューギニア（以下、「PNG」と記す）は、1975年に独立した開発途上の新興国である。銅、金、石油などの天然資源に恵まれ、これらの生産は、同国GDPの約25%、総輸出金額の約70%（1998年）を占める鉱産国であり、資源開発がPNGの経済に占める比重は極めて大きい。

PNGの鉱山開発については、独立以前からアメリカ合衆国、カナダ、オーストラリア等の資本による採掘が進められてきたが、鉱業生産としては少数の大鉱山と少数の鉱産物品目に依存しているのが現状である。また、1990年代にはめざましい新鉱床の発見はなく、探鉱投資額は減少傾向にある。その理由としては、金価格の低下による投資意欲の減退及びPNG政府の行政手続きの遅れによる鉱区権付与の遅延等である。

PNG政府は今後、鉱業関連法制度、行政組織及び鉱物資源情報を整備して一層の外資導入を図るとともに、新鉱床の探査を効率的に行うための基盤情報（リモートセンシング、地質情報システム（GIS）に関する技術）を整備する必要性を認識している。

一方、大規模な鉱山開発による環境問題が顕在化してきており、PNG政府は「中期開発戦略」（1997～2002年）において「天然資源開発と環境保護を両立しつつ次世代への恩恵を考慮した発展」を掲げている。よって、鉱業分野への開発については、環境保全と両立した持続可能な開発への協力が必要になっている。

### (2) 調査団派遣の目的

PNGへの援助重点分野である「環境資源の保全と持続的な利用・開発」にのっとり、「天然資源の持続的開発」及び「鉱害防止を含む環境保全への支援」を念頭に、プロジェクト方式技術協力の案件発掘・形成を図る。

上記については、現在PNG工科大学鉱山学科へ派遣中の個別派遣専門家を研究協力（環境モニタリング技術）へと導く方針であることから、本調査においてはに重点を置き、鉱物探査技術向上の視点から案件発掘・形成を図る。上記研究協力との有機的連携についても考慮する。

また、世界銀行（鉱業行政能力向上に協力）との意見交換を行い、連携・協調を模索すること及び、日本のODAの現状、予算事情及びプロジェクト方式技術協力スキームをPNG側へ説明し、協力可能な案件（候補）につき、検討、考察することも本調査団の目的である。

## 1-2 調査団の構成

担当分野	氏名	所属先
団長・総括	野町隆三	JICA 国際協力専門員
技術協力計画	中島英史	通商産業省資源エネルギー庁鉱業課 課長補佐
鉱業開発	霜鳥 洋	金属鉱業事業団調査事業部精密課 課長代理
探査技術	三箇智二	日鉱金属株式会社資源・原料事業部
計画管理	矢部優慈郎	JICA 鉱工業開発協力部計画・投融资課 職員

## 1-3 調査日程

日順	月日	曜日	行程	滞在先
1	4月15日	土	20:15 東京 (JL767) →	機 中
2	16日	日	→ 4:00 ケアンズ 12:00 ケアンズ → 13:25 ポート・モレスビー (QF383) 15:00 世界銀行事務所	ポート・モレスビー
3	17日	月	10:20 JICA PNG事務所 11:45 PNG Chamber of Mines and Petroleum 15:00 ポート・モレスビー → 15:45 レイ (Lae) (PX128) 17:00 PNG工科大学鉱山学部訪問 (井上専門家)	レイ
4	18日	火	4:40 ホテルチェックアウト → 空港 6:00 レイ → 9:35 タブビル (Tabubil) (CG300) 終日 オクテデイ鉱山視察	タブビル
5	19日	水	7:00 タブビル → 8:45 レイ (フブローケン・ヒル・プロパティ社 契約機) 10:40 森林研究所訪問 (古越リーダー、吉田調整員) 13:30 PNG工科大学鉱山学部訪問 (井上専門家) 15:50 レイ → 16:35 ポート・モレスビー (PX209)	ポート・モレスビー
6	20日	木	8:40 PNG大学地質学部 10:20 鉱業省 11:30 地質調査所 14:15 環境保全省 15:30 JICA PNG事務所報告 16:50 日本大使館報告	ポート・モレスビー
7	21日	金	終日 団内協議及び調査結果概要作成	ポート・モレスビー
8	22日	土	16:00 ポート・モレスビー → 20:25 シンガポール (PX392) 22:45 シンガポール (JL710) →	機 中
9	23日	日	→ 6:30 東京	

#### 1 - 4 調査項目

- (1) PNG の一般状況
- (2) PNG の鉱業の現況
- (3) 技術協力実績
  - 第三国、国際機関
- (4) 国家開発計画等における要請案件の位置づけ
- (5) PNG 側関係機関
  - 援助窓口機関
  - 所轄官庁
  - 実施機関
  - 実施体制、予算
- (6) 日本側協力機関
- (7) プロジェクトの概要
  - プロジェクトの目標
  - 技術移転内容及び協力期間

#### 1 - 5 主要面談者

- (1) PNG 側
  - 1) 鉱業省
    - JOE KINTAU Deputy Secretary, Department of Mining
    - GRAEME HANCOCK Director, Mining Division, Department of Mining
  - 2) 地質調査所
    - R.H. FINDLAY Assistant Director, Geological Survey
    - JOE BULEKA Hydro Geology, Geotechnical Engineering,  
Geological Survey
  - 3) 地球物理観測所
    - CHRIS MCKEE Director, Geophysical Observatory
  - 4) 環境保全省
    - ROLF BRAUN Consultant, European Union, Environmental Monitoring  
and Management of Mining in PNG  
( EU 派遣コンサルタント )
  - 5) PNG 大学
    - HUGH L. DAVIES Professor, Geology Department
    - ROBERT D. WINN Associate Professor, Geology Department

- 6) PNG 工科大学  
 井上博文 専門家 Department of Mining Engineering  
 PAUL S. ITIOGEN Director, Environmental Research and Management Center  
 DAVID PAKNE Lecturer, Department of Mining Engineering  
 DAVID SIANG Lecturer, Department of Mining Engineering
- 7) PNG 鉱山・石油会議所  
 GREG ANDERSON Executive Director, PNG Chamber of Mines and Petroleum
- 8) オクテディ 鉱業会社  
 W. D. ( BILL ) BLENKHORN Executive Manager - Logistics  
 FLORIAN DATI Superintendent, Media and Public Relations  
 RICK LOVE Executive Manager, Mine Division  
 STUART GREEN Manager, Technical Services, Mine Division  
 ROBIN B. MOAINA Executive Manager, Environment and External Relations  
 WILLIAM KUPO Program Manager, Community Relations  
 DAVID WISSINK Manager, Rural and Economic Development
- 9) 世界銀行 PNG 連絡事務所  
 DANIEL A. WEISE Resident Coordinator, PNG Liaison Office

(2) 日本側

- 1) 在 PNG 日本大使館  
 田中辰夫 大使  
 清水一郎 一等書記官
- 2) JICA PNG 事務所  
 岩崎 薫 所長  
 星野明彦 所員  
 稲生俊貴 所員  
 TONY OMBO プログラム・オフィサー
- 3) 森林研究所  
 森林研究計画フェーズ2  
 古越隆信 リーダー  
 吉田 恭 業務調整



## 第 2 章 調査概要と調査結果

項 目	現状と問題点	対処方針	調査結果
<p>第 1 開発計画の動向</p> <p>(1) 国家計画、対象セクター開発政策との整合性</p>	<p>ア 「中期開発戦略（1997～2002年）において、「天然資源開発と環境保護を両立しつつ次世代への恩恵を考慮した発展」を掲げている。</p>	<ul style="list-style-type: none"> <li>・ 左記について、これまでと今後の取り組み方針について聴取する。</li> </ul>	<ul style="list-style-type: none"> <li>・ 日程の都合上、国家計画・財務省との協議ができず、上位計画については事務所にフォーローを依頼。          なお、同省に開発計画専門家が派遣される予定であることから、今後連携していく。鉱業分野については以下のとおり。</li> </ul>
<p>(2) 鉱業の現状と課題</p> <p>ア 現状</p>	<p>ア 金・銀・銅をはじめ原油を含めた鉱産資源の輸出は輸出総額の約70%（1998年）を占め、GDPに占める鉱業部門のシェアは約25%（1998年）に達している。</p> <p>イ 鉱業生産、輸出は国際市況の変化を受けやすく、現在は金市場の低迷に直面している。</p> <p>ウ 鉱業生産は干ばつや洪水などの自然災害の影響を受けやすい。</p> <p>エ 鉱業生産は少数の大鉱山と少数の鉱産品目に依存している。</p> <p>オ 1990年代には、めざましい新鉱脈の発見はなく、探鉱投資（外国資本に依存）額は減少傾向にある。</p> <p>カ 大規模鉱山における環境問題が顕在化している。</p>	<ul style="list-style-type: none"> <li>・ 左記について、課題の解決に向けての施策を聴取する。（経済交流ミッション（1998年8月）の資料を基に具体的な課題と解決のための施策を聴取する）</li> <li>・ オクテディ鉱山を訪問、視察する。</li> </ul>	<ul style="list-style-type: none"> <li>・ 鉱業の振興が経済発展のために不可欠であり、プライオリティーは高い。よって鉱業政策はPNGにおいて極めて重要な政策である。</li> <li>・ 外国投資誘致のために以下の措置を講じている。          課税率の引き下げ          生産財、設備等の輸入関税の引き下げ          投資免税期間の拡大</li> <li>・ 鉱山閉鎖に関する法整備に向けてワークショップを開催している。（2000年6月法制化を目標）</li> <li>・ オクテディ鉱山の廃石の放流が河川に堆積し、洪水、下流域の土壌を浸食している。</li> <li>・ オクテディ鉱山の今後のあり方について、政府は調査を継続中。          半年以内に結論、方針を出す予定。</li> </ul>

項目	現状と問題点	対処方針	調査結果
イ 課題	<p>ア PNG政府による鉱物資源情報の管理及び活用が十分なされていない。</p> <p>イ 鉱業関連法制度、行政組織・機能が弱い。</p> <p>ウ 投資環境が整備されていない。土地所有者との交渉、調整にコストがかかる。</p>	<ul style="list-style-type: none"> <li>政府関係者と意見交換し、現状及び問題を把握する。</li> <li>世界銀行等から状況を聴取する。</li> </ul>	<ul style="list-style-type: none"> <li>データはあるが、活用できるシステムがない。</li> <li>オーストラリアでは空中磁気探査の整備により探鉱投資が促進。PNGではそれらは未整備。</li> <li>世界銀行は行政能力強化支援に取り組む予定。持続性が何より重要。</li> <li>鉱山開発は各鉱山ごとの法令( act )に基づくも、新旧鉱山で環境基準は異なり、統一的な方針がない。</li> </ul>
<p>第2 鉱業分野への我が国援助の動向</p> <p>(1)協力中の案件</p> <p>(2)開発調査等</p>	<p>PNG工科大学鉱山学部における分析技術移転 無償資金協力機材供与 個別専門家派遣( 機器分析技術 ) 研究協力( 環境モニタリング技術 )へ展開の予定</p> <ul style="list-style-type: none"> <li>過去にプロジェクト選定調査( 金属鉱業事業団 )が実施された( 1985、1995、1996年度 )。</li> <li>1997年度に資源開発協力基礎調査の要請あるも、採択には至らず。</li> </ul>	<ul style="list-style-type: none"> <li>協力の現状を関係者から聴取する。</li> <li>鉱業分野の人材育成の現状、課題を聴取する。</li> </ul> <p>日本大使館、JICA事務所にて確認する。</p>	<ul style="list-style-type: none"> <li>鉱山学科及び鉱物処理( 選鉱 )学科が置かれている。</li> <li>予算が不足( 前年比20%減 )のため教員、カリキュラム拡充が困難。</li> <li>最近の就職率は芳しくない。</li> </ul>
<p>第3 他の援助機関の動向</p> <p>(1)世界銀行</p>	<ul style="list-style-type: none"> <li>「鉱業セクター制度強化技術協力プロジェクト」が予定されている。 2000年7月から4年間 1,150万米ドル</li> <li>鉱業政策、鉱山開発契約( 民間企業、自治体、NGOとの関係 )に関する諸制度の見直し</li> <li>鉱業税収入の改善( 関係省庁間の調整 )</li> <li>鉱山投資者への地質情報提供機能の改善 上記を7つの個別プロジェクトで実施する。</li> </ul> <p>うち、地質情報整備プロジェクトは400万米ドルの規模データ取得( ランドサット等の海外地図情報 )に50万米ドル、資機材調達( コンピュータ等 )に350万米ドル</p>	<ul style="list-style-type: none"> <li>現状を聴取する。</li> <li>日本側協力との連携の可能性を検討する。( 我が方が着目する鉱物資源情報管理向上( リモートセンシング、GIS技術 )との関係 )</li> </ul>	<ul style="list-style-type: none"> <li>政府閣議決定のために鉱業省内で検討中。世界銀行としては過去の第1、2次構造調整の反省から、第3次については鉱業セクターを重視し、プロジェクト型の支援も行う方針。</li> <li>世界銀行のプロジェクトは基礎レベルの技術協力( コンサルタントによるトレーニング )である。技術協力の定着化、持続性を図るために我が方協力の意義はある。</li> </ul>

項目	現状と問題点	対処方針	調査結果
(2)EU	<p>環境保全省における鉱山環境モニタリング支援 同省に専門家(コンサルタント)派遣</p> <p>PNG工科大学における環境センター設立構想あり(2001年を想定)</p>	現状を聴取する。	<ul style="list-style-type: none"> <li>政府の環境モニタリング予算は乏しい。</li> <li>四半期ごとに定期モニタリングは行っているが、肝心の分析ができていない。</li> <li>緊急時の対応ができない。</li> <li>同大との協議は進捗していない(内容未確定)。</li> </ul>
<p>第4 協力可能なプロジェクトの検討</p> <p>(1)協力可能な相手先となる関係機関の活動状況</p> <p>(2)PNGにおけるGIS技術、地質データ管理</p> <p>(3)我が国ODA及びプロジェクト方式技術協カスキーム</p>	<p>鉱業省、地質調査所に関し、具体的な組織・機構、役割、人員(人材) 予算、施設、機材状況についての情報は不足。</p> <p>GIS技術 オーストラリアから地図情報を購入し、地質調査所にて鉱物資源情報としての適用を試行中。 (演習を目的としたコンピュータ上の処理であり、現実、実用的なものではない。機材も古い)</p> <p>PNG大学にてGISの授業が行われている。石油開発においてGISの役割が高まっており、石油会社数社から大学にGIS関連コンピュータ機材が供与されている。</p> <p>地質図の整備状況 25万分の1地質図については、オーストラリアが作ったデジタル情報によりPNG全土をカバーしているが、概略図のレベルであり個別地域の情報に乏しい。 また、地図情報の整合性に欠けている。 10万分の1、5万分の3の地質図は整備されていない。</p> <p>成果重視、自立発展性を重視した案件形成が必要。</p>	<p>左記を調査し、課題・ニーズを把握する。</p> <p>ODA、スキームの説明を行う。 (プロジェクト・サイクル・マネージメント(PCM)手法、概要の紹介)</p>	<ul style="list-style-type: none"> <li>組織・体制等詳細につき質問票の回答を取り付け中(事務所へフォローを依頼)。</li> <li>鉱業省の人員：134名 6割が鉱山・地質技師及びテクニシャン、4割が一般事務職員</li> <li>施設 既存の施設に隣接して世界銀行プロジェクト用に建物を建設中(内装工事の段階)。</li> <li>機材 基礎的なものは一通りそろっているが、老朽化している。</li> <li>鉱物資源情報の整備が急務であることを確認。</li> <li>鉱業省へ各種資料配布案件形成(要請発出)の参考としてもらうよう依頼した。</li> </ul>

項目	現状と問題点	対処方針	調査結果
想定される協力の 枠組みの考察			
1 プロジェクト タイトル	鉱物資源情報基盤整備計画(仮称)	左記につき、PNG側の 要望を確認し、その対 応案につき検討する。	次項のとおり
2 実施機関	鉱業省		
3 ターゲット グループ	地質調査所の技師(カウンター パート)		
4 ターゲット エリア	PNG全土(の鉱物資源情報)		
5 プロジェクト 期間	3年		
6 プロジェクト・ サイト	地質調査所(首都ポート・モレス ビーに所在)		
7 上位目標	鉱業分野における投資が促進する		
8 プロジェクト 目標	地質調査所における鉱物資源情報 整備が向上する		
9 成果	1 衛星画像処理、解析、分析がで きるようになる  2 物理探査データの解釈ができる ようになる  3 地質調査所が地質図を作成、編 集できるようになる  4 既存データが容易に活用できる ようになる		
10 日本側投入	専門家派遣(別紙案) 研修員受入れ 機材供与 プロジェクト現地業務費		
11 PNG側投入	世界銀行援助を含む必要な施設・ 機材の確保 プロジェクトに必要な予算、人員 の配置		

別紙

鉱業省側要望及び我が方の協力案

鉱業省要請内容	対応 (案)			開発調査
	プロジェクト方式技術協力			
(地質調査関連)	専門家派遣	その他 (機材、ローカルコスト)	備考	
1 リモートセンシング (a) Basic Training	短期	機材供与	機材内容は世界銀行プロジェクトとの調整が必要	
2 物質探査データの収集 (a) 空中磁気探査の収集 (Airborn Magnetic Survey) ----- (b) Basic Training	短期			○
3 地質図幅の改訂 (a) 全土 (10万分の1) ----- (b) 重要地域 (5万分の1)	長期 (1名)	分析費用	分析費用 (ローカルコスト) の負担必要	○ (ハイランド地域に限る)
4 既存探鉱データのデジタル化	長期 (1名)	機材供与	機材内容は世界銀行プロジェクトとの調整が必要	
(その他)				
1 PANGETプロジェクト			学術的性格が強く、我が方協力の対象としない	
2 地球物理 (地震) 観測所への支援	(個別派遣によるフォローアップ)	地震計据え付け	供与済みの地震計5台のうち3台が未設置	

## 第3章 調査団所見

### 3 - 1 中期開発戦略について

現在、PNGは10年来の経済危機に悩まされている。その主な原因のひとつは人的資源開発の立ち後れである。また、国土は山脈によって南北に分断されていることから、南北をつなぐインフラストラクチャーの未整備も経済・社会開発の遅延の原因となっている。同国の全人口の約38%は今も貧困レベルにあり、労働人口の約65%がGDPシェアで28%程度でしかない農業に従事しているという産業構造となっている。

また、PNGには715の土着言語があるといわれているとおり、ハイランド地域には伝統的生活を営む少数民族が多数存在しており、これらの民族間で生じる伝統的土地所有権の調整が、しばしば開発を困難にする要因となっている。

こうした社会情勢において、政府は、経済の再生に向けて中期開発戦略（1997～2002年）を掲げ、実行中である。これは1995年に始めた構造調整プログラムの政策を強化・推進したもので、その重点分野として、保健医療、教育、インフラストラクチャー、民間セクター開発、良き統治、法整備、執行への予算と開発プログラムづくり、また、それらプロジェクトへの適切なファンド、政府の機能と役割の再定義と人材の強化、経済発展の原動力としての民間セクターの再位置づけ、1996年に始まった地方改革の遂行、といった戦略が位置づけられている。

### 3 - 2 鉱業分野の位置づけ

同国が経済的に発展し、経済危機を克服していくためには、経済発展の原動力となる民間セクターが経済に果たす役割が重要と考えられ、中期開発戦略でも民間セクターが重要な位置づけとなっている。経済部門別のGDPへの貢献をみると、1998年には、農林・漁業が30.5%、鉱業・石油が25.2%で、大半を占めている。輸出に占める割合では鉱業・石油が69.8%を占め、そのなかでも特に鉱業製品は46.6%を占め、外貨を稼ぐ重要な産業となっている。PNGの経済発展を考えると、長期的には第二次、第三次産業への重点のシフトをはじめとする構造調整が必要と思われる。一方、社会インフラストラクチャーの整備や人材資源の開発に時間を要することを考えれば、農林・漁業、鉱業・石油等既存産業、とりわけ輸出に占める割合の大きい鉱業分野での民間セクターの成長は大きな意味を有するものと考えられる。また、こうした産業の活性化や拡大が社会インフラストラクチャーの整備や人的資源の開発を促進するなど経済・社会開発を促進する効果があり、経済の発展に重要な役割を果たすものと考えられる。これは、今回視察したPNG最大規模の鉱山であるオクテディ鉱山が地域経済・社会の開発に多大な貢献を果たしていることから確認が得られた。同鉱山事業者は地域住民、コミュニティーやNGOと共同で村落開発プロジェクトを興すなど、地方行政のサービスを代行しているといってもよいほどの機能を果たしていた。

こうした背景のなかで、近年の鉱業の現況に目を向けると、ここ10年の金、銀、銅の生産は各年の変動はあるものの総じて順調に生産しており、なかでも金の生産量は大きく伸びている。一方で、稼働中の5つの大中規模鉱山のうち、5年後にはミシマ鉱山、10年後にはオクテディ鉱山が閉山の予定である。ニッケル精錬所を併設して生産予定のラム・プロジェクトが開発準備中であるものの、ほかに目立った大型のプロジェクトはない。また、中長期の鉱山開発の動向をみるうえで重要な探鉱投資は、この10年減少を続け、1988年に約8,000万ドルであったものが、1998年には1,500万ドルにまで減少しており、今後の鉱山開発の停滞、ひいてはPNG経済への悪影響が懸念される。

また、オクテディ鉱山の廃石放流に起因する川底の上昇による洪水や、流域の地形変化により環境問題が発生しており、PNG政府が世界銀行の支援を受けて今後の対応を検討しているところであるが、こうした動向が鉱山開発に与える影響は無視し得ない。

### 3 - 3 鉱業分野への協力の方向性

このような環境下において鉱業分野における民間セクターの活動を活性化するには、探鉱投資の促進と鉱山開発環境の整備が必要と考えられる。探鉱投資の促進には、鉱業の歴史が浅く探鉱情報等の蓄積が十分でないことや、厳しい自然条件や社会インフラストラクチャー等鉱山開発環境が未整備であることを考えれば、PNG政府による地質情報等基礎的な情報の整備によって民間セクターの初期投資の軽減を図ることが必要と考えられる。

また、鉱業は多額の初期投資が必要で投資回収に長期を要するため、長期間にわたって安定した操業が保証されることが必要条件である。近年、環境問題が鉱山開発に与える影響は大きく、長期間安定した操業を行うためには、環境面や税制面での法規制の整備と、環境監視の着実な実施が行政に求められる。こうしたことから、鉱業分野における技術協力を行う場合、地質情報等基礎的な情報の整備や、環境面での法規制整備や環境監視の面でプロジェクトを実施することが効果的であると考えられる。

一方、世界銀行は、同国への第3次構造調整ローンを実施中であるが、第1次、第2次の構造調整ローンの実施が不調に終わったことを受け、第3次構造調整ローンでは、鉱業部門における民間企業の成長促進、人材育成、森林・天然資源の保全、行政制度改革の推進等を重点課題としている。世界銀行は、鉱業分野の公的機関の人材の強化、すなわち鉱業開発政策と基準の強化、鉱業省及び税収委員会の能力の強化、個別開発計画の調整、監督、評価機能の強化を目的とした7つのプロジェクトを2000年7月から4年間にわたり、合計1,150万米ドルの予算で実施することを計画している。7つのプロジェクトのうち2つは鉱業省が実施主体となるもので、持続的な開発のための環境評価及び調整能力の開発や、地質調査の強化と地質情報システム作成のための能力開発を意図したものが実施される見込みである。

しかしながら、実施主体である鉱業省では、世界銀行のプロジェクトで人材訓練と機材整備が実

施されるものの、技術協力は基礎的なものに限定される見込みである。また、個別のプロジェクトは短期・小規模なものであるため、習得技術の定着と持続性を図るために、同省は日本の技術協力を要望する意を表した。具体的にはリモートセンシング、探査データ整理及びデジタル解析処理等である。

鉱業省のほか、PNG 大学（地質学部）及び PNG 工科大学（鉱山学部）と協議を行ったが、鉱業省におけるプロジェクトの実施検討を進めることが最適であると判断する。鉱業省と上記の大学機関とは良好な協力関係にあり、今後鉱業省は大学機関と民間鉱業界との連携を進めるための核として存在し、その機能を強化していくことが必要であり、PNG 鉱業の発展に対する鉱業省の役割は大きい。



## 付 属 資 料

### 1. パプア・ニューギニアの鉱業の概況

(出典：金属鉱業事業団 海外鉱業情報 (2000年5月) から抜粋)

### 2. Mining in Papua New Guinea



## 1. パプア・ニューギニアの鉱業の概況

(出典：金属鉱業事業団 海外鉱業情報(2000年5月)から抜粋)

### パプアニューギニア

キャンベラ海外調査員 徳増有治報告

柳町勝彦報告

1999年前半は、台湾をめぐる外交政策のふらつきや世銀との不協和などがあったが、7月の政権交代により、経済は安定する気配が見えてきた。Mekere Morauta 卿を首班とする新政権の目的は、政府の改善、キナの安定、公共部門のパフォーマンスの改善、投資及び経済発展に対する障害の除去である。

PNG 銀行による最新のデータによれば、1999年のインフレ率は18.2%であった。キナの大幅な値下がり、キナ建ての経常収支の改善に貢献したものの、1999年1～9月期の国際収支は7,700万キナの赤字となった。また、1999年の外貨準備は危機的な低水準(1億米ドル)となった。

PNG 経済にとって、資源エネルギー分野の果たす役割は極めて大きく、鉱業・石油がGDPの25%強を占め、そして輸出の約7割を占めている。その中でも鉱業分野の貢献は大きく、輸出の46%強を占め、外貨獲得の重要な手段となっている。主な鉱山としては、Ok Tedi、Porgera、Misima、Lihir などの大規模プロジェクトと中規模のTolukuma、などがある。

鉱業活動については、これまで順調に推移してきているが、その将来については必ずしも楽観できる状況には無い。ここ10年の金、銀、銅の生産は、年によって変動はあるものの総じて順調に推移しており、中でも金については大きく生産量が伸びている。しかし、操業中の5つの主要鉱山のうち5年後にはMisima 鉱山が、10年後にはOk Tedi 鉱山が閉山の予定であるにもかかわらず、Highland Pacific 社を主体とするRamu ニッケルプロジェクトが開発準備中であるほかは、他に目立った大型プロジェクトは無い。

また、中長期の鉱山開発の動向を見る上で重要な探鉱投資は、この10年間減少を続けており、1988年には8,000万ドルであったものが、1998年には1,500万ドルにまで減少し、鉱業石油協会(Chamber of Mines and Petroleum)では、1999年の総支出は1,000万ドルに満たないと推計している。

こうした状況の中、PNG 政府は、世界銀行の協力の下に、鉱業分野の開発促進に向けた民間企業の成長促進、人材育成、行政改革等のプログラムを準備中であり、その早期の実施と具体的な効果に期待が寄せられている。

パプアニューギニアの金、銀、銅の生産推移

	金 (kg)	銀 (kg)	銅 (t)
1994	58,654	65,695	209,329
1995	51,701	65,153	212,737
1996	51,573	59,036	186,665
1997	48,482	49,165	111,515
1998	61,357	58,033	152,200
1999	45,900 (Sept)	N/A	103,500 (Sept)

(出展) Bank of PNG Quarterly Reports and Graeme Hancock, Director, Mining Division, Department of Mineral Resources, PNG Review, Mining Journal, 1999年10月

主要鉱山の生産量

	金 (kg)		銀 (kg)		銅 (t)	
	1998年	1999年	1998年	1999年	1998年	1999年
Ok Tedi	12,860	n. a.	26,084	n. a.	151,556	n. a.
Porgera	22,606	19,622	2,849	2,758	-	-
Misima	5,783	6,163	18,120	19,664	-	-
Lihir	14,734	19,445	413	n. a.	-	-
Tolukuma	2,362	2,233	10,304	8,817	-	-
Small Scale	1,948	n. a.	170	n. a.	-	-

Source: Mining Annual Review 1999 and Company Reports

(主要鉱山の動向)

Ok Tedi 鉱山

Ok Tedi 鉱山の生産水準は回復したものの、鉱山に関連した環境問題が大きな政策課題となり、OTML にとって深刻な問題となっている。この問題は非常に複雑で、政府の環境、経済、社会的な目的および株主をすべて満足させる選択肢は存在しない。

ジレンマのポイントは、今現在、オクテディ鉱山の操業を止めたとしても、Fly 川流域環境への効果は 2010 年以降でないと現れず、その効果も操業を継続した場合の 10%程度でしかない、ということである。すなわち、問題となっている河川流域のオーバーフローと、それに伴

う熱帯雨林の消失(Dieback)が、2010年までは、操業を継続した場合と同様の規模で進行していくものと想定されることから、操業中止による地域経済や地域の生活環境への致命的な影響はもとより、総輸出の20%、国家収入の10%、GDPの8.5%、雇用の1.5%を占める鉱山の閉山による国の経済へのダメージ、各種の対策や、住民に対する保障経費の捻出等を考えた場合、操業中止というオプションの選択は極めて困難であるということである。これについては、現在も引き続き調査が継続中であり、今後のPNG政府の判断が世界的に注目されている。

#### Porgera 鉱山

1999年の生産は、技術的な問題により前年に比べ減少した。1999年中にStage 2の採掘は完了し、坑内の上層部および古いストーピング地域を通して採掘が進んだ。その結果、坑内の支えとして使用されていた鉄による鉱石の汚染に対処しなければならないという問題に直面した。金の鉱床については従来型の処理法ではうまく対処できず、採算のとれる処理法を開発するための多くの努力が行われてきた。1998年から1999年にかけてフローテーションサーキットが拡張され、グラビティサーキットも装置され、採掘の採算性を改善した。

1998年のジョイントベンチャーによる探鉱活動により、埋蔵量は12%上方修正され、現在では、可採年数は18年と見積もられている。

#### Lihir 鉱山

1999年の金の産出高は、625,127ozで前年比20%増となった。第4四半期には166,321ozを記録した。これは、11月にtailings de-aeration tankが取り換えられたためで、その結果として稼働時間と稼働効率は大きく改善した。

様々な硫黄のレベルに対し、金の生産を最適化するためのフローテーションの試験プラントは、11月に稼働を止め、2000年の再稼働を待っている。第4四半期中、石灰消費の削減プログラムは、成功のうちに終了した。石灰と煨焼マグネシアの混合により、大幅なコストの削減が可能となった。3つのオートクレーブと酸素プラントすべてが、この四半期に初めて同時に稼働し、188千ozの生産を記録して、年間累計では459千ozとなった。

酸化サーキットは順調に稼働し、安定的な生産レベルを保った。煨焼マグネシアを加えて石灰の消費量を減らす試みは成功し、生産コストのさらなる削減に寄与すると期待されている。

#### Misima 鉱山

1999年12月31日時点での確認埋蔵量は、金77万千oz、銀721万ozで、同時点での可能採掘年数は5年と見積もられている。同時に、推定埋蔵量は確認埋蔵量より金は506千oz、銀は2,555千oz多くなっている。

採掘は掘削破砕(drill-and-blast)と露天掘(shovel-and-truck)中心である。金の採取には、標準的な破砕(crushing)、研磨(grinding)、CIP(carbon-in-pulp)フローシートを使用している。

1999年の産出高は1998年よりも、金が185,915ozから198,129ozへ、銀が583千ozから632千ozへと、それぞれ増加した。

#### Tolukuma 鉱山

1999年12月までの年度上期の金の産出高は、Tolukumaにとって記録的なものであった。鉱山は低コストを維持しており、現在の計画では、可能採掘期間中少なくともこの水準を保つ事に焦点を当てている。

Gulbadi Ore Bodyでは、坑内での初めての試掘でストーピング・ブロックの採掘に成功し、ドロポイント・ストーピング・メソッド(the draw point stoping method)がうまくいくことが立証された。Gulbadiの中では、この採鉱法を利用するための開発とストーピングのレイアウトが計画されている。

水力発電によるコスト削減を目的としたThe Mine Electrical Upgrade Projectは完了した。採鉱現場の高圧送電網により、すべての設備及び地下施設に電力が供給されている。

1999年10～12月の金の産出高は、93.76%増加した。生産の増加は、包括的な冶金学的な試行の成果であり、この成果は採鉱現場に応用されている。そしてこれは、年度後半に実行が予想されているプラントの改善の基盤をなすものである。

#### Bougainville 鉱山

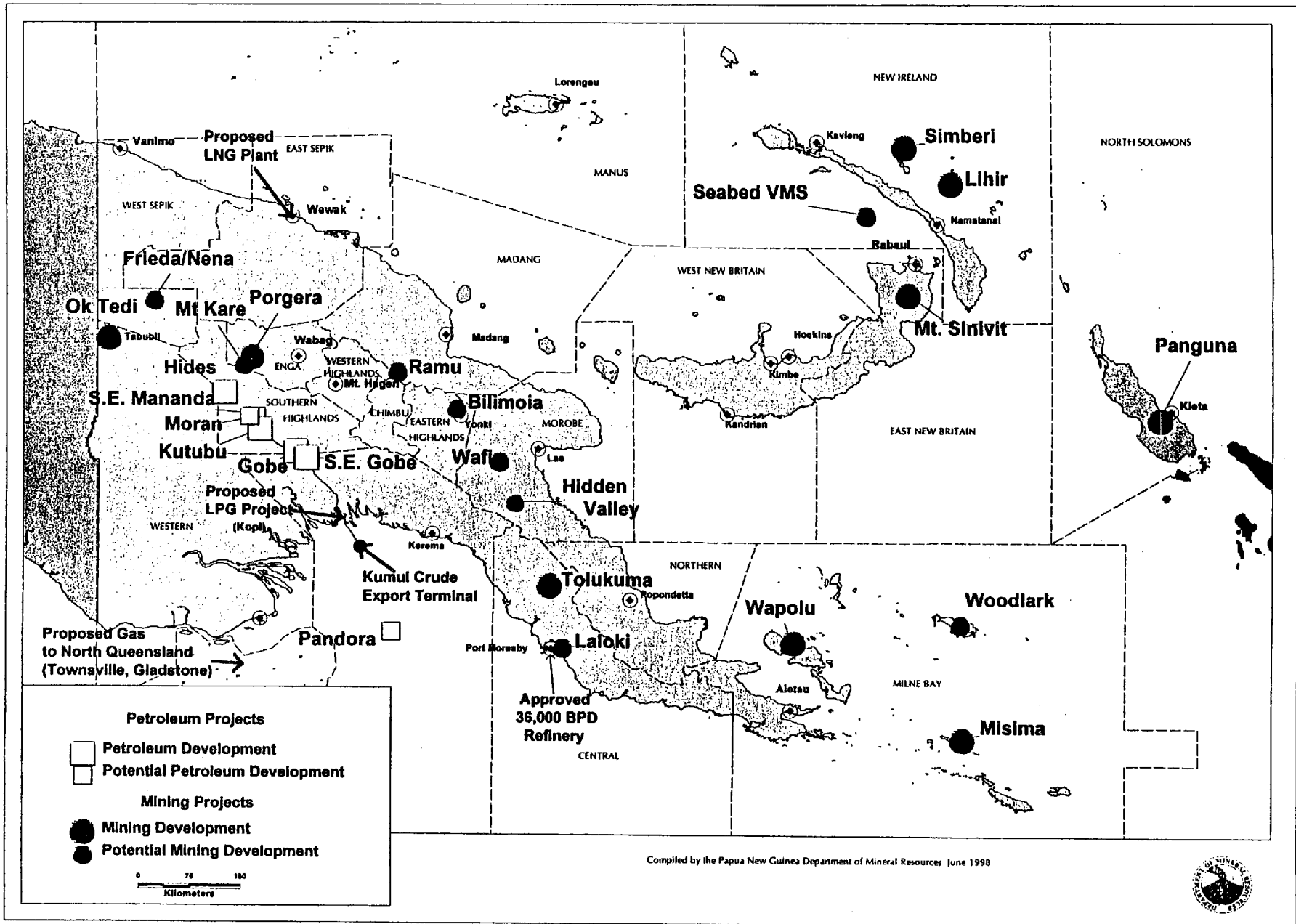
Bougainvilleでの紛争は、公式には1998年4月に終わり、和平交渉の結果として新しくBougainville Peoples Congress(BPC)が設置された。1999年5月に独立運動指導者の一人Joseph KabuiがBPCの議長として選ばれた。1997年の和平交渉の開始以来、公共サービス及びインフラストラクチャの回復には大幅な進歩が見られた。しかし、Bougainvilleが完全に機能を回復するまでには多くの課題が残っている。依然として、独立を目指す島の指導者たちとPNG政府の間には緊張が続いている。新しいリーダーシップの構想は、2000年7月に予定されているNew Bougainville Development Summitで詳細が明らかになる。このサミットの目的の一つは、地域全体の生活基盤の回復に重点を置いたBougainville経済の再建策を議論する事である。サミットでは、また人的資源問題も討議されるであろう。

(2000年5月18日)



**DEPARTMENT OF MINERAL RESOURCES**

# **Mining in Papua New Guinea**







## **MINING IN PAPUA NEW GUINEA: OPPORTUNITIES FOR JAPANESE INVESTORS**

### **INTRODUCTION**

Mining is one of the most significant contributors to the economy of Papua New Guinea. The mining industry has a relatively short history, which is primarily a reflection of the very recent geographical exploration of the country. The first significant discovery of gold was on Sudest Island in 1888 and other islands in the Louisiade Archipelago. Since this time the mining industry has been an integral part of the economy. The early discoveries led to an ongoing exploration and development effort, which continues to the present day. Initially, attention was focussed on alluvial and high grade hard rock gold targets on a reasonably small scale, mainly in the Papuan region controlled by the British authorities up until 1914. The New Guinea region was under German colonial administration until 1914 and was not open for prospecting until after the establishment of the Australian administration in 1914. The early discoveries were mostly in the islands and coastal regions of Papua. Early discoveries and developments included the Umuna and Kulumalia underground workings on Misima Island, the Kulumadau mine on Woodlark Island, and several small copper mines at Laloki near Port Moresby. The discovery of gold near Wau in 1922 by William 'Sharkeye' Park triggered the first significant exploration of the New Guinea mainland. The discovery of Edie Creek followed in 1926 with the development of the Edie Creek, Karuka and Day Dawn mines.

The first major investment in mining came with the development of alluvial gold dredging operations in the Wau-Bulolo area in the 1930s. The Bulolo Gold Dredging Company operated up to a total of eight dredges in the Bulolo Valley from 1932 to 1965. Apart from a short break during World War II the dredging operations continued until 1965, when they closed down due to a combination of depressed gold prices and exhaustion of the available resources. At their peak, the dredging operations recovered up to 250,000 ounces of gold per year from a total of six dredges.

The first major hard rock discovery to be developed was the Panguna copper deposit on Bougainville Island. It was first discovered in 1962 and seriously explored in 1964 during a world wide exploration effort targeted at the identification of copper resources. This period saw not only the discovery of Panguna but also the Ok Tedi, Frieda River and Yanderra copper deposits.

With the development of the Bougainville copper mine in 1972 Papua New Guinea entered an era of large-scale hard rock metalliferous mining. The development of the Ok Tedi copper mine in 1984 and later the Misima, Porgera, Tolukuma and Lihir gold mines have resulted in a further extension of both the scale and scope of mining operations in Papua New Guinea.

In addition to the mining projects currently in operation, there are a significant number of other identified resources which may be developed in the short to medium term (Table 7). As a result of these potential future developments, the contribution currently made by the mining industry to the national economy is likely to continue well into the future.

The contribution of the mining industry to the economy is significant and multi-faceted. The government receives significant taxation, royalty, duty, and dividend revenues from the industry. Mineral exports account for the majority of total exports and therefore the majority of foreign exchange earnings. Employment is generated both directly by mining and exploration companies and also indirectly through service suppliers and companies. The non-mining private sector also benefits from spin off business activity. The industry has contributed to infrastructure development in areas of otherwise trackless jungle. The early exploration of many of the remote areas of Papua New Guinea has to a large extent been fuelled by the search for minerals and oil.

## **THE MINING INDUSTRY IN PAPUA NEW GUINEA**

### **The Industry Today**

The mining industry in Papua New Guinea revolves around a small number of very large projects. There are currently four large-scale mines and one medium scale mine in production. The large-scale operations are the Ok Tedi, Porgera, Misima and Lihir mines. In addition to the producing mines there is the large scale Bougainville Copper mine at which operations are currently suspended. Production rates at all of these operations are large by world standards. Ok Tedi rates as the eighth largest copper producer in the world with Porgera and Lihir rating in the top ten gold producers in the world. At the time of its closure, Bougainville Copper Ltd also rated in the top five copper mines in the world.

Over the last few years there has been a movement towards the development of smaller scale mining operations. To date this has resulted in the successful development of the Tolukuma gold mine in Central Province and the granting of three other mining leases for smaller scale gold mines.

Copper production has varied from a high of 207,000 tonnes per year in 1992 to a low of 111,500 tonnes in 1997. The average production of just under 200,000 tonnes per year places Papua New Guinea as the ninth largest copper producer in the world.

Gold production from all mines has varied considerably over the last ten years from a high of 71 tonnes in 1992 to a low of 48 tonnes in 1997. Papua New Guinea ranked number 10 in the world as a gold producer in 1995 although this position slipped in 1997 as a result of production losses caused by the severe El Nino drought. Commencement of full scale production from Lihir (approximately 20 tonnes per year) in 1998 pushed Papua New Guinea back up to a total gold production rate of 60 tonnes per year in 1998 and a further increase to 68 tonnes is expected in 1999. This would place Papua New Guinea into the position of eighth largest gold producer in the world. Combined

production from all likely sources in the next ten years could result in production rates in excess of 90 tonnes per year.

### Contribution to the National Economy

The mining industry in Papua New Guinea has played a pivotal role in the development of the economy and the country as a whole, and will continue to do so for many years to come. Since the 1890's, mining and petroleum exploration efforts have often been the cause of the establishment of basic contact and infrastructure development in many remote areas. With the development of larger scale operations this contribution to the economy has dramatically increased. Mining has today emerged as the primary exporter of Papua New Guinea produce and a significant contributor to Gross Domestic Product (GDP). Mineral product exports accounted for 46.6% of total exports in 1998, and when combined with petroleum exports jointly account for 69.8% of total exports. Mining and petroleum were the second largest contributor to GDP in 1998 after agriculture (Table 1). Mining and petroleum contributed 25.2% of total GDP in 1998. This percentage is expected to increase in the immediate future with the achievement of full scale gold production from Lihir, expansion of oil production from the Gobe and Moran Oil Projects, as well as a possible gas pipeline to Queensland.

**Table 1: Sector Contributions to Economic Activity - Percentage Share.**

	EXPORTS % 1998	GDP % 1998(Est)	EMPLOYMENT % 1990
Agriculture/Forestry/Fisheries	30.2	30.5	30.0
Mining and Petroleum	69.8	25.2	2.4
Manufacturing	-	7.6	8.3
Electricity	-	1.4	0.9
Construction	-	5.1	13.8
Wholesale, Retail Trade	-	7.7	8.5
Transport	-	4.8	8.5
Business Services	-	0.9	5.1
Other Services	-	16.7	22.9
Total	100.0	100.0	100.0

### Exports

Tables 2 and 3 present mineral and petroleum production and export statistics for the period 1987 to 1998. In Kina terms there has been more than a doubling in the value of both gold and copper production over the period. Copper production reached a peak in 1988 when Ok Tedi and Bougainville were in simultaneous production, only to fall in 1989 with the closure of the Bougainville mine. The general upward trend in gold production is expected for at least the next ten years as new mines are developed.

The significant decline in 1997 mineral export figures occurred as a result of the prolonged El Nino drought in Papua New Guinea. This caused operations at the Ok Tedi mine to be suspended due to low river levels in the Fly River. The Fly River is the logistics lifeline for the Ok Tedi operation, used for shipping fuel and supplies into the mine site, and for shipping copper concentrate out. In the 1997 calendar year, mine and mill operations were suspended for a period of over five months. This situation led to a

significant reduction in copper and gold exports in 1997. Ok Tedi is not only a significant producer of copper but also a large producer of gold as a co-product in its copper concentrate. In normal operating years gold production from Ok Tedi averages 15 tonnes.

The drought also impacted copper and gold production figures in 1998, with full production at Ok Tedi not being re-established until the end of the first quarter 1998.

**TABLE 2: PNG MINERAL PRODUCTION 1987-1998**

YEAR	GOLD (kg)	SILVER (kg)	COPPER (tonnes)
1987	34,903	62,224	217,699
1988	34,593	68,915	218,642
1989	25,380	92,507	203,825
1990	32,323	112,327	170,221
1991	59,810	123,630	204,459
1992	69,241	93,108	193,359
1993	60,096	96,017	203,184
1994	58,654	77,758	206,368
1995	51,701	65,153	212,737
1996	51,573	59,036	186,665
1997	48,482	49,165	111,515
1998	61,357	58,033	152,200

**Table 3: Mineral and Petroleum Exports by Value: K(million) F.O.B.**

Year	Copper	Gold	Silver	Oil	Total
1985	164.2	318.8	6.9		489.9
1986	156.0	398.5	6.7		561.2
1987	281.9	422.9	10.1		714.9
1988	446.9	405.1	9.5		861.5
1989	344.9	316.9	14.3		676.1
1990	349.2	393.2	15.1		757.5
1991	323.8	666.9	14.6		1005.3
1992	313.5	745.9	10.7	301.4	1371.5
1993	256.3	681.6	12.1	817.8	1767.8
1994	367.4	702.3	10.3	702.7	1782.7
1995	754.5	840.1	13.1	827.7	2435.4
1996	387.0	773.6	10.1	1073.9	2244.6
1997	259.8	718.7	8.2	852.2	1838.9
1998	395.7	1227.8	15.5	813.1	2452.1

Source - Bank of PNG Quarterly Economic Bulletin.

Table 4 presents comparative statistics on the export performance of the main industry sectors in Papua New Guinea. The contribution of mineral and petroleum products to total exports has increased from 53 percent of total exports in 1985 to nearly 72 percent in 1995. It experienced a slight reduction in 1996 to 68.1% primarily as a result of weakness in the world copper market and a slight decline in gold exports. 1997 figures show a significant decline with mineral and petroleum exports account for only 60.3% of total exports due to the drought. 1998 saw an increase in mineral product exports to 69.8% as a result of a return to full production by all mining operations. Mine production figures for 1998 are presented in Table 5.

**Table 4: Total Exports by Value: K(million) F.O.B.**

Year	Total Minerals	Agriculture	Forest Products	Marine Products	Other	Total Exports	Mineral & Petroleum share%
1985	489.9	330.2	67.3	12.1	26.7	926.2	52.9
1986	561.2	331.9	74.7	7.9	25.1	1000.8	56.1
1987	714.9	268.9	110.9	11.0	17.5	1123.2	63.6
1988	861.5	255.2	97.5	7.5	34.4	1256.1	68.6
1989	676.1	270.1	96.2	8.1	61.1	1111.6	60.8
1990	757.5	204.6	79.6	8.2	72.5	1122.4	67.5
1991	1005.3	180.9	90.2	10.4	80.0	1390.5	72.3
1992	1371.5	203.1	148.2	9.3	110.0	1862.6	73.6
1993	1767.8	270.1	410.4	7.8	71.2	2527.3	69.9
1994	1782.7	374.6	494.4	10.3	0	2662.0	67.0
1995	2435.4	498.0	449.7	16.7	0	3399.8	71.6
1996	2244.6	573.7	467.3	10.4	0	3296.0	68.1
1997	1838.9	770.3	409.3	9.5	0	3051.6	60.3
1998	2452.1	846.5	170.9	41.5	0	3511.0	69.8

Source - Bank of PNG Quarterly Economic Bulletin.

**Table 5: PNG Mine Production 1998**

MINE	GOLD (kg)	SILVER (kg)	COPPER (tonnes)
Ok Tedi	12,860	26,084	151,556
Porgera	22,606	2,849	
Misima	5,783	18,120	
Lihir	14,734	413	
Tolukuma	2,362	10,304	
Small Scale Miners	1,948	170	

Source - Department of Mineral Resources Quarterly Report.

**Table 6: PNG Mineral Export Statistics 1988-1998**

Year	Gold kg	Export Value millions		Copper t.	Export Value millions	
		Kina	US \$		Kina	US \$
1988	31,874	378.3	312.6	218,700	500.9	414.0
1989	18,811	287.9	176.3	204,000	482.8	295.6
1990	31,021	361.0	343.4	170,200	398.5	379.2
1991	58,749	748.3	712.8	204,500	444.7	423.6
1992	68,327	745.9	765.0	193,359	313.5	320.0
1993	58,690	681.6	690.0	203,184	256.3	260.0
1994	58,654	702.3	600.0	206,329	367.4	310.0
1995	51,701	840.1	630.0	212,737	745.5	560.0
1996	51,573	773.6	580.0	186,665	387.0	290.0
1997	48,482	718.7	395.0	111,515	259.8	143.0
1998	61,357	1141.0	543.1	152,200	629.7	299.7

Note: US\$ export values are calculated from year-end exchange rates of Kina to US\$.

## Linkages to the Non-Mining Economy

As a result of the very localised impact mines have on their economic, physical and social environment, as well as low labour intensity, mines are often referred to as enclave developments. There is the perception that linkages to the outside business community are poor. This does not mean that the general economy does not benefit from the operations, rather that the direct impact is localised. The claim that mining is isolated from the rest of the economy requires careful examination. The contribution of mining to downstream business and employment opportunities in associated industries, contractors and retailers in Papua New Guinea has not been quantified. It is, however, known to be significant as evident by the severe dislocation of businesses in many parts of the country following the suspension of mining operations at Bougainville.

## Exploration Expenditure in the Economy

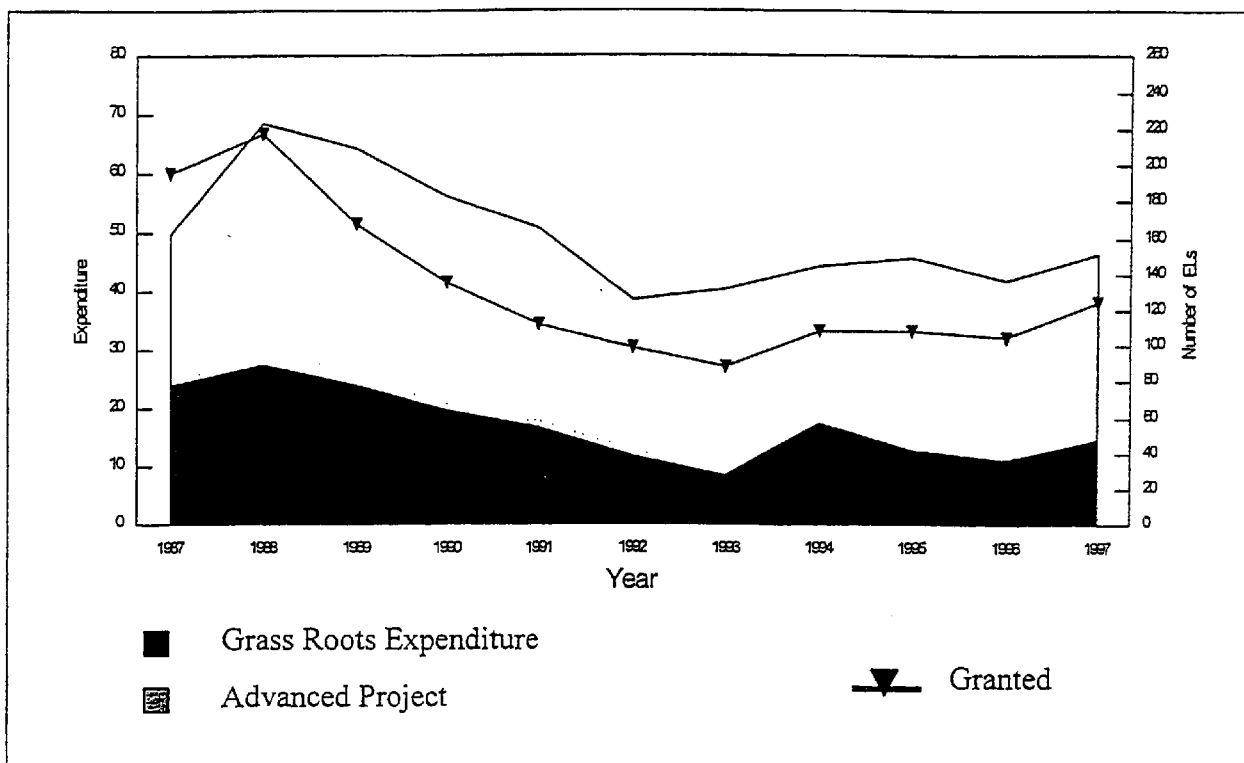
Mineral and petroleum exploration budgets have contributed in a major way to economic growth over the last 20 years. During the period 1988 to 1990 combined Mineral and Petroleum exploration expenditures reached a peak of K281 million per year, and averaged K225 million per year. Mineral exploration accounted for close to K70 million in 1988. Over the period 1988 to 1992 exploration expenditures progressively declined and stabilised at a rate of around K40 million per year thereafter. Exploration expenditures in 1997 totaled K46.7 million. Table 6 and figure 1 provide a summary of exploration expenditure and exploration licensing activity over the period 1987 to the present. At the end of 1998 there were 156 Exploration licences in force and a further 42 applications pending covering a total area of 97,803km<sup>2</sup>. The exploration expenditure figures presented in Table 6 are broken down into grassroots and advanced exploration. Advanced exploration refers to those projects which have sufficiently identified the characteristics of a mineral resource to undertake order of magnitude development studies.

**Table 7: PNG Exploration Statistics 1987-1997**

YEAR	GRASSROOTS EXPLORATION (K millions)	ADVANCED EXPLORATION (K millions)	TOTAL (K millions)	Number of Els
1987	24.0	25.9	49.9	195
1988	27.5	41.2	68.7	217
1989	24.1	40.2	64.3	167
1990	19.8	36.5	56.3	135
1991	16.8	33.9	50.7	112
1992	11.9	26.9	38.8	99
1993	8.6	32.0	40.6	89
1994	17.5	27.0	44.5	108
1995	12.8	33.1	45.9	108
1996	11.3	30.6	41.9	105
1997	14.6	32.1	46.7	125
1998	11.26	19.91	31.2	116

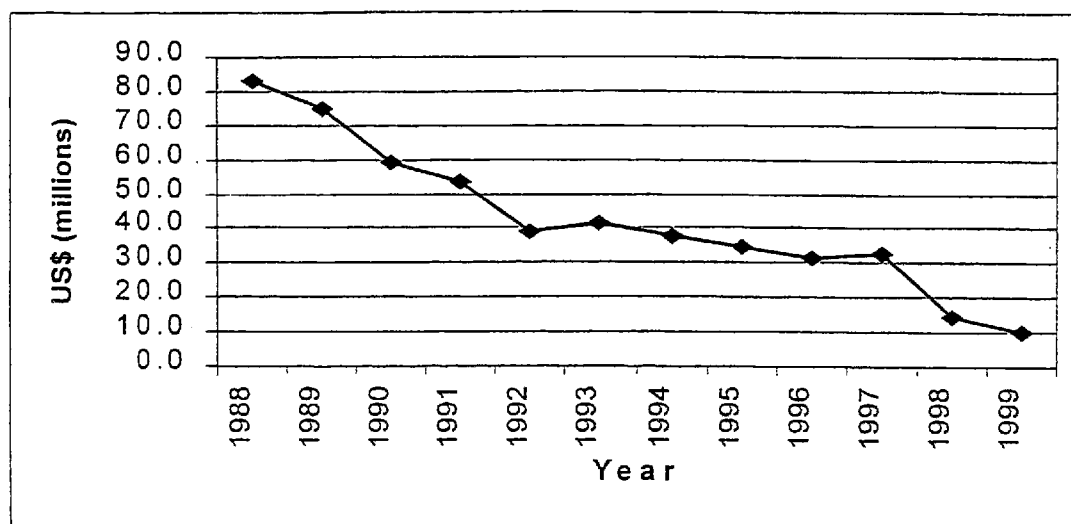
Source – Department of Mineral Resources Quarterly Report.

Figure 1: Mineral Exploration Expenditure 1987-1997 (K millions)



The situation reflected in Figure 1 does not illustrate the full picture with respect to exploration expenditures. The Kina figures mask the impact of the declining value of the Kina against the US Dollar since 1994. Figure 2 presents exploration expenditures in US Dollars.

Figure 2 Exploration Expenditure in Papua New Guinea (US\$) 1999 estimated



Ongoing mineral exploration is essential to the future well being of the economy. Without exploration there would be no new mineral discoveries and the mining industry would be a short to medium term temporary industry. The time period from discovery to

production is variable but often quite long. From discovery to the commencement of production at Panguna was 8 years, which for a mine of that scale is very short. By contrast Ok Tedi was discovered in 1968 and did not reach development until 1984. Likewise, the Frieda copper deposit was discovered in 1967 and has still yet to be developed. Lihir was discovered in 1983 and finally reached production in 1997. This long gestation period demonstrates that the mines of the next decade must be in the process of discovery now. The decline in grassroots exploration in Papua New Guinea since 1988 and the change in focus to advanced projects is a cause for concern for the long-term future of the industry.

## **MINING PROJECTS**

### **Lihir**

The Lihir mine completed construction in late 1997 on Lihir Island in New Ireland Province 590 km north east of the mainland of Papua New Guinea. Lihir Gold Limited is a publicly listed company with the principal shareholders being; Southern Gold (Rio Tinto 75% and Vengold 25%) holding 22.8%, Niugini Mining Ltd, 17.1%, Mineral Resources Lihir, 10.3% (8.5% of which is on behalf of the people of Lihir), Vengold Inc, 6.8%, with the balance of 43% held by private and institutional investors. The mine is managed and operated by the Lihir Management Company, a wholly owned subsidiary of Rio Tinto Ltd.

Mining is by open pit methods, with a production rate of 2.85 Mt of ore per year to the mill. The current 37 year mine life plans for mining in the pit to take place over a 15 year period with high grade ore being fed direct to the mill. Low grade ore is being stockpiled for later reclamation and processing over the 22 year period following the cessation of open pit mining operations.

Apart from a small tonnage of surficial oxide material, the Lihir ore body is refractory with a high sulphide content. Metallurgical treatment is by whole-ore pressure oxidation followed by CIL for gold recovery.

Commissioning commenced in May 1997 with 1998 being the first full year of production. Gold output reached 519,824 ounces for the year despite some downtime caused by problems with the pressure oxidation autoclave brick linings. Relining of the autoclaves will continue into 1999 and is likely to have some effect on 1999 production.

The Lihir project presents the developers with some unique challenges with the reserve lying within an active geothermal area and immediately adjacent to the ocean. At the end of 1998 the base of the open pit was already over 30 metres below sea level. A major well-point de-watering system is in place along the coastline and is reported by the company to be operating successfully. Rock temperatures in a significant proportion of the ore exceed 100 degrees Celsius and special explosives and detonating cord are required for blasting at these high temperatures. To date these challenges appear manageable and have not caused any delays in development.



Throughout 1998 the company constructed a new 300tpd oxygen plant to supplement existing oxygen capacity. This was commissioned in the first quarter of 1999 and is expected to increase gold production by an average of 100,000 oz of gold per year over the following two years. Expansion plans are also under consideration to increase production to over 1 million ounces per year.

Ore reserves at the end of 1998 were 96.3 million tonnes, grading 3.81 g/t gold for a total of 11.8 million ounces. Total resources are 500 Mt grading 2.65 g/t gold for a total of 42.6 million ounces.

## **Ok Tedi**

The Ok Tedi mine is a large porphyry copper deposit in a very remote area of the Star Mountains of the Western Province of Papua New Guinea. It lies some 18 km east of the border with the Indonesian province of Irian Jaya. The mine lies at an altitude of 2000m in a very high rainfall area receiving between 8.5 and 10.5 metres of rain per year.

Ok Tedi Mining Limited (OTML) is owned 52% by BHP, 27.5% by the PNG Government, 18% by Inmet Mining Corporation of Canada and 2.5% by the project area traditional landowners.

Total mine production averages 235,000 tonnes per day of which 80,000 to 85,000 tonnes per day is ore treated through the mill.

The El Nino drought of 1997 saw mine production severely reduced due to transportation difficulties on the Fly River for a period of over six months. Copper concentrate produced in the 1997 calendar year contained a total of 111,515 tonnes of copper, 8,182 kg of gold and 15,846 kg of silver. Of this, a significant amount remained stockpiled at the river port of Kiunga or at the mine until the drought finally broke in February 1998. The mine had returned to full production by the end of March 1998. Total production for the 1998 calendar year was 12,860kg of gold, 26,084kg of silver and 151,556 tonnes of copper in concentrate.

OTML has received some controversial press coverage over the last few years concerning the disposal of tailings and waste rock into the Ok Tedi and Fly River system. Monitoring and research continues in order to reach a greater understanding of the environmental impact of the mining project on the river systems. In late 1996 OTML had identified its preferred waste management option involving the dredging of mine derived sediments out of the Ok Tedi River. The mobilisation of the dredger to the dredging site in the Lower Ok Tedi River was significantly delayed as a result of the prolonged drought causing river levels to be too low for the dredger to be mobilised up river. Trial dredging commenced in March 1998 and operated successfully up until the end of the year producing sand from the river at a rate of 17 million tonnes per year. A major review of the success of the dredging trial is being carried out and a decision on whether dredging is a viable environmental option for the future is to be assessed around mid 1999.

Ore reserves as at the end of May 1998 were 343.9 Mt at 0.88% Cu and 0.92 g/t Au.

## **Porgera**

The Porgera gold mine lies in Enga Province in the Highlands of Papua New Guinea. The mine commenced production as an underground mine in 1990 and has subsequently made the transition to an open pit. The underground operation ceased in October 1997 and currently ore is derived solely from the open pit operation. Based on current ore reserves, open pit mining operations are scheduled to be complete around 2010. Gold production will continue until at least 2015 from low grade stockpiles. The open pit mining rate is currently 210,000 tonnes per day of ore and waste.

The mine has produced close to 8.3 million ounces of gold since commissioning in 1990 with a peak annual production in 1992 of 46.2 tonnes of gold (1.48 million ounces). Production rates for the remainder of the mine life are expected to be in the range 600,000 to 800,000 ounces of gold per year. Gold production is from a refractory gold ore body where sub-microscopic gold is bound within pyrite grains. The gold recovery circuit includes flotation of the sulphide minerals followed by pressure oxidation, leaching and conventional CIP gold extraction. The mill has a throughput capacity of 17,000 tonnes of ore per day.

Placer Dome has acquired a 50% shareholding in the operation through its takeover of both Highlands Gold Ltd and Placer Pacific Ltd. Goldfields (RGC) Ltd holds 25%, Orogen Minerals holds 20%, and the Porgera landowners and Enga Provincial Government, 5%.

Production in 1998 was 726,806 oz (22,606kg) of gold and 98,614 oz (2,850kg) of silver.

The Porgera Joint Venture announced a 12% upgrading of ore reserves in 1998 and exploration is continuing to identify additional ore. Proved and probable ore reserves as at June 30, 1998 were 104 Mt at 3.6 g/t Au containing 12 million ounces of gold.

## **Misima**

The Misima mine is located on Misima Island in the Milne Bay Province in eastern Papua New Guinea. The mine is an open pit gold mine, which has on average produced over 300,000 ounces of gold per year. The mine commenced operations in 1989 and has to date produced some 88.2 tonnes (2.8 million ounces) of gold and 472.9 tonnes (15.2 million ounces) of silver. The mine works a low-grade ore body but is able to maintain low operating costs due to its strategic location in an island setting, adjacent to the coast. Gold and silver are produced from a conventional CIP gold processing plant.

Ownership of Misima Mines Pty Limited is Placer Dome 80%, and Orogen Minerals Ltd 20%.

Gold production declined from an average of 330,000 oz (10,300kg) over the years 1990 to 1995 to 186,000 oz (5,788 kg) in 1998. Silver also declined from an average 1.9 Moz (60,000kg) per year from 1990 to 1995 to 590,000 oz (18,366kg) in 1998. These

reductions were forecast and occurred primarily as a result of a combination of harder ore and lower head grades as the mine approaches the end of its life. Present indications are that open pit operations will continue until mid 2000 with processing of low-grade stockpiles continuing until 2005.

Ore reserves as at December 1998 were 29.8 Mt grading 0.97 g/t Au and 9.2 g/t Ag at a 0.7 g/t gold equivalent cutoff.

### **Tolukuma**

The Tolukuma resource was discovered in 1986 by Newmont Exploration and was ultimately developed by Dome Resources Ltd with first gold production in December 1995. The mine lies in the Central Province, 100 km north of Port Moresby in the rugged Owen Stanley Mountains. Access is only by helicopter and all mine activities are helicopter supported.

Gold production commenced in December 1995 at a rate of 100,000 tonnes of ore and 50,000 ounces of gold per annum. Production in 1998 totaled 76,000 ounces of gold and 331,000 oz of silver. The ore is free milling and treated with a conventional CIL plant followed by Inco process tailings detoxification.

The mine initially operated as a small open pit and in 1997 commenced underground mining operations. Head grade from the open pit for the years it operated averaged 15.5 g/t Au and 49.4 g/t Ag. By mid 1997 all ore production was being derived from the newly developed underground mine. Underground head grades for 1998 averaged 21.6g/t Au and 164.0 g/t Ag.

The mine life was initially estimated to be 5 years, however exploration activities surrounding the known mineable reserves have been positive, and potential exists to extend the mine life by several years.

Reserves and resources as at the end of 1998 were 909,000 tonnes at an average grade of 21.9 g/t gold and 93.0 g/t silver.

### **Wapolu**

The Wapolu gold mine is located on Fergusson Island in the Milne Bay Province. The resource was discovered in 1985 and finally developed in 1995. A mining lease was granted to Union Mining NL for a combined heap leach/vat leach and CIL gold mining project. Mineable reserves were initially estimated to be 1.6 million tonnes at 2.4 g/t gold. The estimated mine life was 3 to 4 years at a planned production rate of 34,000 ounces per year.

Construction commenced mid 1995 and production started towards the end of 1995. Commissioning and production problems continued into 1996 with heap leach proving unsuccessful. Vat leach was also attempted but the high clay content of the ore resulted in slow percolation and low production rates.

The mine ceased operations in 1997 and was decommissioned and rehabilitated. The area surrounding the old mine site contains potential for the identification of more resources and exploration activities are targeted to identify sufficient resources to undertake a larger scale operation.

### **Simberi**

The Simberi gold project lies in the Tabar Islands some 40 km north west of Lihir. It was granted a Mining Lease in December 1996 for the development of a medium scale gold mine treating oxide ore overlying a sulphide resource of unknown size. The project is owned by Nord Pacific and proposes to produce 40,000 oz of gold per annum for 5 years.

Oxide ore reserves were last assessed in August 1996 as 4.4 Mt grading 1.54 g/t Au. This ore reserve is based on a zero stripping ratio and a 0.5 g/t Au cut-off.

The project remains on hold as a result of depressed gold prices. Exploration is ongoing and it is expected that the project will be developed in the near future.

### **Mt Sinivit (Wild Dog)**

The Mt Sinivit mining lease (previously known as Wild Dog) lies in East New Britain Province some 75 km from Rabaul. This is planned to be a small scale open pit mine to produce 10,000 ounces of gold per year. Ore reserves are 306,000 tonnes grading 4.0 g/t Au. Initial development activities were halted due to the depressed gold price and are not expected to recommence until there is a significant shift in gold price to above US\$350 per ounce.

### **Bougainville**

The Bougainville Copper Project commenced operations in 1972 and was producing at a rate of 166,000 tonnes of copper and 450,000 ounces of gold per year at the time of its forced closure in 1989. Over its operating life it produced 3 million tonnes of copper and 305 tonnes (9.7 million ounces) of gold in concentrate.

The mine was forced to close in May 1989 following an armed rebellion by disgruntled mine area landowners. Although there are significant moves towards a peaceful resolution of the conflict on the Island there is no time frame for recommissioning of mining operations on the island.

The suspension of operations at the Panguna mine in 1989 was a major blow to the economy of Papua New Guinea. At the time of its closure the mine accounted for nearly 10% of GDP, 36% of export earnings and 18% of government revenue.

Access to the mine site on Bougainville to enable a detailed review of the mine and its infrastructure is still not possible. When conditions on Bougainville permit, Bougainville Copper Ltd (BCL) intends to review the costs of reopening the mine. Pre-conditions to

reopening the mine necessarily include the restoration of political stability on the island, and a clear statement from the Bougainville community in favour of re-establishment of mining operations. Resumption of production would take approximately 2 years from the complete restoration of stability on the island and would be subject to an assessment of the economic viability of resumed operations.

Bougainville Copper Limited is owned 53.6% by Rio Tinto, public shareholders 27.3% and the PNG Government 19.1%.

Remaining ore reserves are 691 Mt at 0.4% Cu and 0.47 g/t Au, sufficient for a mine life of 15 to 16 years at the production rate prevailing prior to closure.

## **FUTURE PROSPECTS AND OPPORTUNITIES FOR JAPANESE INVESTORS**

Papua New Guinea is still considered to be under-explored and highly prospective for the discovery of new mineral deposits. There are a significant number of deposits which have already been discovered but not yet developed. These include both large and small-scale deposits which are likely to be exploited in the years to come as infrastructure development and commodity prices enhance their economic viability. The following is an outline of some of these potential future developments. Summary information on future developments is detailed in Table 7. Opportunities for Japanese investors and construction and development companies arise from all new operations. Three projects are nearing development, being the Frieda Copper Project which already has Japanese investment through the OMRD consortium of Japanese companies. The Ramu Nickel Project is nearing development and is seeking Joint Venture partners for the project and will need considerable technical support and construction expertise for the development of its specialist refining technologies. The Morobe Gold Project is a conventional gold project with an estimated capital cost at this stage of US\$ 75 million. This also offers opportunities for construction companies. Other less advanced exploration projects also require investment at this point in time and offer more speculative investment opportunities for those companies willing to take exploration risk.

The projects offering these opportunities are summarised below.

### **Frieda Copper**

A large porphyry copper deposit was first discovered at Frieda River near the border of the East Sepik and West Sepik Provinces in the 1960's. In 1987 Highlands Gold Ltd (now Highlands Pacific Ltd) took over the Exploration Licence and embarked on an aggressive exploration and metallurgical testing programme to develop a mining project based on the Nena and Frieda deposits. In 1997, Cyprus-Amax Inc entered the joint venture and has become the manager of the Frieda exploration project.

The total porphyry copper resource is estimated to be in excess of 1000 million tonnes at 0.5% copper and 0.3 g/t gold. The high sulphidation Nena resource, which lies adjacent to the porphyry system, is 60 Mt grading 2.0% copper and 0.6 g/t gold with an additional oxide gold cap of 14.5 Mt grading 1.4 g/t gold.

A mining pre-feasibility study was completed by Highlands Pacific in early 1996 resulting in a proposed development strategy including a leach, solvent extraction and electro-winning circuit to produce LME grade A copper. Estimated capital cost of the project was US\$1.6 billion, whilst operating costs were projected to be in the lowest quartile of the global cost curve. Exploration on the site is ongoing with the project being progressed towards feasibility by a joint venture consortium led by Cyprus Amax Inc.

Opportunities for Japanese investors include an increased share of the project through increasing the profile of OMRD Frieda, construction and infrastructure development.

### **Ramu Nickel**

The Ramu Nickel Cobalt project is located in Madang Province. This project is based on a lateritic nickel occurrence discovered in 1962. Highlands Gold Ltd (now Highlands Pacific Ltd) took up the area in 1990 and has undertaken both resource and metallurgical studies. Total measured and indicated resources are currently estimated at 72.2 Mt grading 1.0% Ni and 0.1% Co. Inferred resources add another 71 Mt, bringing the total to 143 Mt grading 1.0% Nickel and 0.1% Cobalt.

A bankable feasibility study was completed in December 1998 and demonstrated attractive rates of return on investment and low overall operating costs. The feasibility study and a proposal for development and environmental plan have been submitted to the PNG Government for approval. It is anticipated that government approvals will be received in the third quarter 1999 with construction commencing late 1999 or early 2000.

Opportunities for Japanese investors include an opportunity to invest directly in the project as the main project proponent, Highlands Pacific Ltd may well be seeking a new Joint Venture Partner in the project. Construction and infrastructure development opportunities also exist with infrastructure needed including a wharf, 60 MW thermal power station and a limestone calcination plant. Shipping opportunities also exist with project consumables being largely imported.

### **Morobe Gold**

The Morobe gold project lies in the Wau area of Morobe Province. Wau is the site where the first large scale discovery of gold took place in Papua New Guinea in 1923. The project comprises three principal prospects, the Hidden Valley, Kaveroi Creek, and Hamata prospects. The ground adjacent to the three identified targets is also highly prospective.

The Morobe Gold project took a major step forward in 1996 as a result of the amalgamation of the Rio Tinto Hidden Valley - Kaveroi Creek prospect with the adjacent Goldfields RGC Hamata prospect into a single project. The combination of the three prospects under one project significantly enhances the viability of mine development. Exploration activities were aggressively advanced throughout 1997 leading to the preparation of a pre-feasibility study presented in early 1998.

A new joint venture company comprising Aurora Gold Ltd and the Commonwealth Development Corporation gained control of the project in 1998. Evaluation of the prospects continues with a feasibility study planned for presentation around mid 2000.

Opportunities for Japanese investors include construction and infrastructure development.

### **Wafi**

Rio Tinto holds the exploration licences over an advanced exploration prospect at Wafi situated in the Morobe Province near Lae. The prospect has two distinct mineral occurrences. A porphyry copper prospect has been drilled out giving a resource of 100 Mt grading 1.27% copper and 0.67g/t Au. An epithermal gold prospect on the same tenement contains in the order of 26.1 Mt grading 3.5 g/t Au. Recent drilling by Rio Tinto has identified a new high grade zone, which has significantly expanded these resources, but no new resource estimate is as yet available.

Rio Tinto are currently seeking new joint venture partners for this project.

### **Mount Kare**

Located in the Enga Province of PNG the Mount Kare gold mining project has had a short but colourful history. It was the location of a significant landowner gold rush in 1988 which is reputed to have produced nearly 1 million ounces of gold.

Exploration of the hard rock potential of the Mt Kare area has continued through 1998 by a joint venture comprising Carpenter Pacific Resources of Australia and Madison Enterprises of Canada. Drilling results to date are encouraging with uncut identified resources of 20.4 Mt grading 5.6 g/t gold and 28.7 g/t silver at a cutoff grade of 1 g/t Au. Drilling is ongoing and further increases in resources are expected.

The geology of the area has significant similarities to the Porgera mine which lies some 11 km to the north east on what appears to be a structural trend.

### **Other Prospects**

Several promising small mining ventures are in the advanced stages of feasibility studies. The Kainantu Gold project in the Eastern Highlands is also the focus of a new exploration programme following announcement of a joint venture between Highlands Pacific Ltd and Nippon Mining of Japan. On the outskirts of Port Moresby at Laloki lies a small massive sulphide copper gold zinc prospect which is being evaluated for possible development. The Woodlark Island gold prospect has completed a mining feasibility study but with currently depressed gold prices further reserves are required to justify development.

New prospects which have been identified in the recent past which appear interesting include the Left May River copper/zinc/gold massive sulphide occurrence near the Frieda River Project, and the Crater Mountain Gold discovery.

## **Sea-floor Mineral Exploration**

Of considerable interest has been the granting of Exploration Licences covering two offshore areas in the Manus Basin to Nautilus Minerals Corporation. The licences cover known areas of sea-floor massive sulphide mineralisation, (VMS black smoker deposits). The mineralisation in the Manus Basin is associated with andesitic and dacitic source rocks with high gold, silver, copper and zinc grades and low lead grades. Average copper and gold grades for 59 samples collected to date from the Pacmanus deposit are 9.9% copper and 15 g/t gold. Grades from 24 samples from the Suzette deposit average 15.3% copper and 21 g/t gold.

These areas lie in water depths of around 1600 metres and raise interesting possibilities for the future of sea-floor mining within Papua New Guinea's territorial waters. Offshore mining technology has to date been focussed on either shallow water diamonds or very deep water (>5000m) manganese nodules. New technologies for the exploration and mining of these deposits will be required and perhaps provide the greatest challenge for the project. A research cruise to the area will soon be testing the effectiveness of a remotely operated drill rig for testing the grade and thickness of the deposits.

Japan is at the forefront in marine mining and exploration technologies and this project offers exciting opportunities in this area.

## **Small Scale Alluvial Gold Mining**

Small scale alluvial gold miners produced over 62,000 oz of gold in 1998. This is primarily from hand method operations although there are a small number of mechanised operations in production. A new Government extension service for small scale miners commenced in 1998 and it is hoped that production from this sector will continue to increase over the next few years.

## **Undiscovered Resources.**

Papua New Guinea is considered to be geologically highly prospective for new mineral discoveries. Its geological setting on the "Pacific ring of fire" makes it highly favourable for further discoveries of large scale porphyry copper/gold and epithermal gold deposits. There are also large areas of ultramafic rocks which are prospective for lateritic nickel deposits in many parts of the country. The country remains relatively unexplored compared to Australia, and holds promise of many more discoveries in the future. The major limiting factor to future discoveries is the difficult logistics of working in remote and rugged country as well as some difficulties with land access resulting from the customary land tenure system.

## **FUTURE ECONOMIC CONTRIBUTIONS FROM THE MINING INDUSTRY**

With production from currently operating mines and expected future production from new mines in the medium term, some preliminary estimates of the future value of mineral



production can be made. The currently very low commodity prices for both gold and copper do not encourage new developments at an early stage.

## **Gold**

Gold production is expected to increase over the next decade with new production coming from a number of both large and small operations. Large scale gold developments such as Morobe are expected to add to the increased gold production resulting from the ramping up of Lihir. In addition to the new gold mines, production of gold as a by-product of copper mining from the Frieda Copper deposit is also expected to contribute to gold exports before 2010. The Wafi Zone A gold prospect and the Mt Kare prospect also have significant potential for development as future gold mines.

A number of small to medium scale mines such as Woodlark, Kainantu, Simberi and Sinivit could also add to the total. Production from these new mines will more than offset the expected slight decline in gold production resulting from the closure of the Misima mine around 2005.

The small scale alluvial gold mining sector is also set to make significant contributions to gold production from both hand and mechanised alluvial gold mines around the country. Total gold production from this sector is expected to increase to in excess of 2.5 tonnes (80,000 oz) per year by the year 2000.

A large unknown with respect to future gold production levels is whether operations are ever re-established at the suspended Panguna mine on Bougainville Island. Bougainville Copper Ltd was not only a major copper producer but also exported a large quantity of gold each year in the copper concentrate. The average gold production from BCL over the last five years of operations was close to 15 tonnes (480,000 oz) per year.

## **Copper**

Production from Ok Tedi is expected to continue at current levels through to at least 2010. Copper production is expected to rise with the commissioning of a new mine at Frieda River in the West Sepik Province by the Cyprus-Amax, Highlands Pacific joint venture. Copper production is currently estimated to commence at a rate of 220,000 tonnes per year. The development of the Wafi copper-gold resource is also possible in the medium to long term. Production from Wafi is unlikely before the year 2010. An additional small source of copper production is the small scale Laloki copper prospect near Port Moresby. This mine would also produce small quantities of zinc, gold and silver.

In the event that the Bougainville copper mine is re-commissioned, a significant increase in copper production would occur. Production from BCL, if re-established, is likely to be at a rate of 150,000 to 175,000 tonnes per year.

## **Nickel and Cobalt**

Nickel production from the Marum deposit in the Ramu Valley is potentially a new commodity for Papua New Guinea, diversifying the industry base away from the current strong copper and gold bias. In addition to nickel the Marum deposit has by-product cobalt which would add to the value of production. The deposit also contains chromite but this does not at present appear to be economic to exploit. The project developer, Highlands Pacific Ltd, has completed a feasibility study into developing the resource and has applied for project approvals from the Government of Papua New Guinea. Production is projected to commence in 2001 at a rate of 33,000 tonnes of Nickel and 2,800 tonnes of Cobalt per year.

## **Implications for Government Revenue**

As a result of an increase in the number of mining developments, government revenues from the sector are expected to increase over the next decade. All tax revenues from the mining industry are directed to the Mineral Resources Stabilisation Fund which is a fund administered by the Bank of Papua New Guinea (Central Bank) in order to smooth the effects of mining related revenue collection on the economy. Direct tax revenues from the mining and petroleum sector over the period 1993 to 1998 have averaged over K300 million per year (Bank of PNG, 1999). These revenue streams should be able to be maintained by new projects coming on stream to replace those reaching the end of their productive lives. The low commodity prices currently being experienced are likely to negatively impact on company profitability and therefore reduce direct taxation in the 1999 year.

## **Non Fiscal Benefits to the Papua New Guinea Economy.**

All mining projects require the establishment of basic infrastructure in the area of the mine development. This is often a cost carried by the mine developer in order to ensure the effective operation of the mine. This is especially so in remote areas where basic infrastructure is generally non-existent. The infrastructure developments usually last well beyond the life of the mine and provide centres for economic development into the future. In addition, mining companies are allowed to develop non-mine related infrastructure under a tax credit scheme. This is currently seen as an effective way of delivering infrastructure in remote areas which the government finds difficult to service.

Employment opportunities will also increase significantly with the proposed mine developments. Direct employment in the mining industry could double over the next decade and employment in mining related service industries will follow suit.

## **Conclusions**

The mining sector remains the driving force behind the Papua New Guinea economy. The current contribution provided the industry is expected to continue in the medium to long term with the likely establishment of several new mineral developments over the next five to ten years. The direct effect of these new developments on the economy will

be significant in terms of both increases in GDP, exports and foreign exchange as well government revenue.

**Table 8: Current and Future Mineral Production Estimates\***

Mine	Commodity	Rate	Value K mill/yr	Start Year	Mine Life Yrs
<u>Currently Producing Mines</u>					
Ok Tedi	Copper (t)	190,000	570	1984	25
	Gold (oz)	500,000	350		
Misima	Gold (oz)	200,000	140	1988	14
Porgera	Gold (oz)	750,000	525	1989	18
Tolukuma	Gold (oz)	60,000	42	1995	5
Lihir	Gold (oz)	600,000	420	1997	40
Alluvial Gold	Gold (oz)	60-100,000	42-70	1880	??
<u>Future Developments</u>					
Ramu	Nickel (t)	33,000	580	2001	30-40
	Cobalt (t)	2,800	175		
Morobe Gold	Gold (oz)	300,000	210	2001	15
Nena Frieda	Copper (t)	220,000	660	2005	20
	Gold (oz)	365,000	255		
Wafi	Gold (oz)	200,000	140	2005	10
	Copper (t)	100,000	300	2010	
Simberi	Gold (oz)	40,000	28	2000	5
Woodlark	Gold (oz)	50,000	35	2000	7
Mt Sinivit	Gold (oz)	10,000	7	2000	4
Laloki	Copper (t)	4000	12	2002	4
	Zinc (t)	1300	1.8		
	Gold (oz)	15,000	10.5		
<u>Future Restoration ?</u>					
Bougainville	Copper (t)	160,000	480	2005?	12
	Gold (oz)	350,000	245		

Price Assumptions: Gold = K 700 /oz Copper K 3000 / tonne NSR.

\* These are Dept of Mineral Resources estimates only and may not reflect company policy.