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Papua New Guinea Baseline Study

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Contents

List of Figures **5**

List of Tables **5**

Acknowledgements and Additional Inputs **5**

Acronyms **6**

Kina Conversion Rates **7**

Part One: Introduction **9**

1.1 Introduction 9
1.2 Research Aims and Objectives 9
1.3 Methods 10
1.4 Report Outline 11

Part Two: The Papua New Guinea Minerals Sector **12**

2.1 Introduction 12
2.2 A Brief History of the Papua New Guinea Minerals Sector 12
Key Sources *14*
2.3 The Current Mining Industry in Papua New Guinea 14
Current Mining Operations *15*
Porgera *15*
Lihir *16*
Ok Tedi *16*
Misima *18*
Tolukuma *19*
Small-Scale Mining *19*
Exploration *20*
Ramu Nickel *20*
Kainantu *21*
Hidden Valley/ Hamata *21*
Wafi *21*
Resource Estimates *21*
Frieda/ Nena *22*
Resource Estimates *22*
General Comments *22*
Stakeholders *24*
Mining Corporations *24*
The National Government *25*
Local Communities *25*
Provincial Governments *25*
Local Level Government (LLG) and Institutions *25*
The broader Papua New Guinea Community *26*
Employees (Local, National and International) *26*
Non-Governmental Organisations (NGOs) (National and International) *26*
Suppliers (local, national and international) *27*
Sources *27*
2.4 Economic Issues 27
Formal measures *27*
Government Revenues *30*

Employment *33*
Sources *33*
2.5 The Current Regulatory and Policy Framework 34
Fiscal Regime *36*
Sources *38*
2.6 The Small-Scale and Artisanal Mining Sector 38
Sources *39*
Community Issues 39
Community in Papua New Guinea *39*
Mechanisms for Community Consultation and Participation *41*
Community Change and Transformation *42*
Economic Impacts *43*
Social Impacts *46*
Political Impacts *48*
Cultural Effects *49*
Community Attitudes Towards Mining *50*
Sources *52*
2.8 Environmental Effects of Mining 52
General Comments *52*
Environmental Issues *52*
Ok Tedi *55*
Porgera *56*
Lihir and Misima *58*
Tolukuma *58*
Ramu *59*
Rehabilitation *59*
Communicating Environmental Information *59*
Sources *60*
2.9 Corporate Investment Considerations 60
Sources *61*
2.10 Governance 61
Sources *62*

Part Three: Challenges For Sustainability 63

3.1 Introduction 63
3.2 Concern, Contention and Conflict 63
A Future for the Industry? *63*
Diseases and Curses: Management at the National Level *64*
Community Issues *66*
Benefit Distribution and Use *66*
Representation and Participation *68*
Communication Among Local Stakeholders *69*
Tailing Disposal *70*
3.3 Continuity and Change 71
Structural and Political Constraints on Reform *71*
Mining, Entrenched Interests and Dependency *71*
Lack of Effective Governance *72*
Key Drivers of Change *73*
External *73*
Internal *74*
3.4 New Directions and Initiatives Proposed or Currently Underway 75
Mine Closure Policy *75*
Sustainability Policy *76*
Local Level Initiatives at Various Mine Sites *76*
3.5 Broader Lessons from Papua New Guinea 78

Development Forum *78*
Communication and Relationships *80*
Local Level Initiatives *81*
Sustainability and Mine Closure Policy *82*

Part Four: The Way Forward 83

4.1 Introduction 83
4.2 Gap Analysis 83
Knowledge *83*
The Economic Impact of the Industry at the National Scale *83*
Revenue Flows and Utilisation at the Local Scale. *83*
Processes of Change in Communities *84*
Communication *84*
Long-Term Impacts on Flora, Fauna and Water Quality *84*
Policy *85*
Practice *85*
Communicating with Stakeholders *85*
Links with LLG and Provincial Government *85*
Role of Social Assessment and Monitoring *86*
Capacity *86*
Government Regulators *86*
Community Affairs sections *87*
Provincial Government and LLG *87*
4.3 Moving Forward: Proposals for Future Directions 87
Research Agendas *87*
Policy Reform *88*

References 90

Appendix One: Terms of Reference 95

1. Purpose of Terms of Reference and the Baseline Study 95
2. PNG Baseline Study - Project Design 95
Part I: 96
Part II: 97
Part III: 97
3. Research Proposal For Baseline Study 97
4. Expected Results 97

Appendix Two: List of People and Organisations Consulted 98

List of Figures

Figure 1: Mining Operations and Exploration Prospects, Papua New Guinea 7
Figure 2: Exploration Expenditure, 1987-2000, US$ 21
Figure 3: Exploration Licences Valid at Year End, 1987-2000 22
Figure 4: Exports of Minerals, by Value, 1973-2000 25
Figure 5: Mineral Export Volumes, 1980-2000 26
Figure 6: The Operations of the MRSF, 1975-2000 28
Figure 7: Mineral Export Values and MRSF Receipts, 1975-2000 29
Figure 8: Porgera Mine Compensation Payments by Quarter, 1987-1992 63

List of Tables

Table 1: Mineral Production by Mine, Papua New Guinea, 2000 13
Table 2: Porgera Production Statistics, 2000 14
Table 3: Lihir Production Statistics, 2000 15
Table 4: Ok Tedi Production Statistics, 2000 16
Table 5: Misima Production Statistics, 2000 17
Table 6: Tolukuma Production Statistics, 2000 18
Table 7: New Exploration Licence Applications Lodged, 1997-2001 21
Table 8: Value of Compensation Payments Made by Project, various years 40
Table 9: Distribution of Royalties at Porgera, 1996 41
Table 10: Tailing and Waste Rock Summary 50

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Acronyms

ANU	The Australian National University
APL	Acceptable Particulate Level
APT	Additional Profits Tax
BCL	Bougainville Copper Ltd
BGD	Bulolo Gold Dregding
BHP	The Broken Hill Proprietary Company Ltd
CIC	Community Issues Committee
CRA	Conzinc Riotinto Australia Ltd
CROs	Community Relations Officers
CSIRO	CSIRO
EPG	Enga Provincial Government
EL	Exploration Licence
FIFO	Fly-In, Fly-Out
g/t	grams per tonne
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
IBP	Integrated Benefits Package
INA	Institute of National Affairs
km	kilometres
LLG	Local Level Government
LMC	Lihir Mining Company
MCH	Maternal and Child Health
MDC	Mine Development Contract
ML	Mining Lease
MMSD	Mining, Minerals and Sustainable Development
MOA	Memorandum of Agreement
MPs	Members of Parliament
MPI	Mineral Policy Institute
MRSF	Mineral Resources Stabilisation Fund
Mt	million tonnes
NGG	New Guinea Goldfields
NGOs	Non-governmental organisations
OTDF	Ok Tedi Development Foundation
OTML	Ok Tedi Mining Ltd
PDA	Porgera Development Authority
PEAK	Porgera Environmental Advisory Komiti
PJV	Porgera Joint Venture
PNGCMP	Papua New Guinea Chamber of Mines and Petroleum
PRG	Peer Review Group
RNF	Ramu Nickel Foundation
SML	Special Mining Lease
SSG	Special Support Grant
STD	Submarine Tailings Discharge
STDs	Sexually transmitted diseases
t	tonnes
ToR	Terms of Reference

tpd	tonnes per day
TSS	Total Suspended Sediment
WHO	World Health Organisation

Kina Conversion Rates

Year	One Kina equals
1990	US$1.05
1991	US$1.01
1992	US$1.06
1993	US$1.02
1994	US$0.99
1995	US$0.78
1996	US$0.76
1997	US$0.70
1998	US$0.48
1999	US$0.38
2000	US$0.36
2001	US$0.30 (as at 13 September)

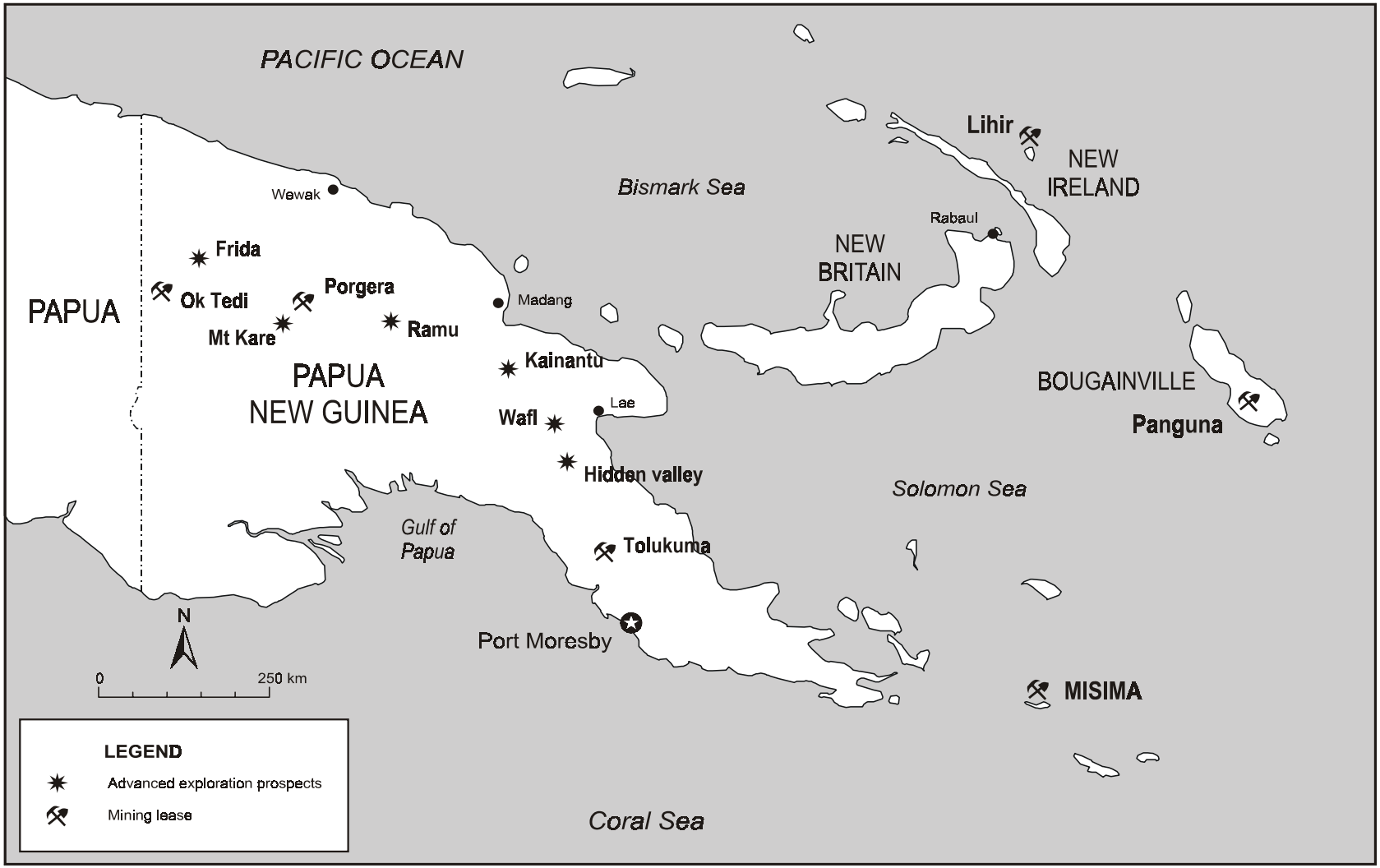

Figure 1: Mining Operations and Advanced Exploration Prospects, Papua New Guinea

Part One: Introduction

1.1 Introduction

This report has been written in response to Terms of Reference (ToR) issued by the Mining, Minerals and Sustainable Development (MMSD) project, London, and subsequently developed further in discussion between the author of this report and MMSD project staff. The original ToR are included in Appendix One.

The MMSD project 'is an independent process of participatory analysis with the objective of identifying how mining and minerals can best contribute to the global transition to sustainable development' (MMSD 2000). The project is managed through the International Institute for Environment and Development (IIED), London, and funded, predominately, by the Global Mining Initiative (GMI), a grouping of the major global mining houses.

In this context, and in line with the ToR, this report seeks to provide an

> *understanding of the mining and minerals sector in Papua New Guinea and the circumstances that have a bearing on the role of the sector in the society, economy and environment of the country.*

In addition to this baseline material, the ToR also requires an analysis of

> *gaps in knowledge, practice, policy, communications and/or capacity, and an agenda and specific proposals for future progress in the sector.*

This Baseline Study provides an overview of the sector paying particular attention to the contribution of the industry to Papua New Guinea in economic, social and environmental terms. The major areas of contention and conflict as identified by various stakeholders are discussed and, through this, the identification of areas where better knowledge, practice or policy are required.

1.2 Research Aims and Objectives

In terms of its geological setting, Papua New Guinea is one of the most prospective countries in the Asia-Pacific region. A number of world class mining operations have been developed over the last 30 years, and further significant mineral deposits have been identified. The Papua New Guinea minerals industry has presented a number of challenges for stakeholders, and has been the subject of local, national and international concern and conflict.

In line with the structure of the ToR provided by MMSD, the Aims of the study are:

1. To provide an overview of the Papua New Guinea mining and minerals sector. This includes the sector's historical development; the current state of mining and exploration activities; policy and regulatory framework; small-scale mining; economic, environmental and community issues connected with the industry; corporate investment considerations; and governance and communication issues.
2. To provide an analysis and discussion of key issues confronting the sector. The report presents different stakeholder perspectives on a range of issues identified as being critical

to enhancing the contribution of the sector to sustainable development. These include the major areas of concern, contention and conflict, structural and political constraints on reform, the identification of key drivers of change in the industry, new directions or initiatives underway or proposed, and the discussion of areas of good practice in the sector which may have wider applicability.

3. To identify major gaps in knowledge, policy and practice for the sector and the development of an agenda and specific proposals for taking the sector forward.

The MMSD project has also commissioned two other pieces of work on Papua New Guinea. These are "Capacity Building in Papua New Guinea for Community Maintenance During and After Mine Closure" by Professor Richard Jackson, and a report on "Small-scale Mining" by Blasius Susapu from the Papua New Guinea Department of Mining. As a result less emphasis is put on these aspects (particularly the last of these two areas) in this report.

1.3 Methods

Given the limited resources and time available for this study (ToR were issued in May, work begun in June and the final report submitted in September), there was not the opportunity to visit each of the mines, or to speak to a wide range of stakeholders. Instead two major sources of material were used as the basis for this study.

4. Literature review. The Papua New Guinea minerals industry has been the subject of intensive interest and research covering a broad range of fields, particularly in the last 15 years. This material includes academic, corporate, government, journalist, consultant and non-governmental organisation (NGO) writings and perspectives. It covers all areas of the sector of relevance to this report including geology, environmental effects, anthropology, economics, sociology, corporate reports and releases, and history. This substantial body of literature has provided the bulk of the material for this report.

5. Port Moresby visit. A visit was made to Port Moresby from 2–8 July 2001. This provided the opportunity to interview key corporate and government stakeholders in the industry regarding their perspectives on the issues of interest to the MMSD project. A list of those individuals and organisations that were consulted as part of this study is included as Appendix Two. The visit also allowed the collection of the most recent industry reports and statistics of relevance to this study.

A key stakeholder group not included in these discussions was that of mine-affected community members. This was due entirely to the time and logistical constraints involved in accessing any of the mines within the timeframe and resources of the project. Given that landowning communities have been participating in, and speaking out on, mineral development processes for over a decade, and that affected communities have also been the subject of research by a wide range of academics, consultants and NGOs over this period, there is ample material available on the views of this group.

It should also be noted that one constraint on the incorporation of stakeholder perspectives into the content of this report was the refusal of NGOs, particularly Australian ones, to participate in the MMSD research process. The NGO perspective contained in this report is then primarily derived from material already in the public domain.

1.4 Report Outline

Following this introduction, the remainder of this report is structured around the three aims outlined above, as derived from the ToR. The first section (Part Two) provides an overview of the social, economic, historical, environmental and political settings and impacts of the industry. Information about each of the mines is combined with more general statements where appropriate, particularly in terms of management and governance of the industry at the national level.

Part Three addresses three key areas of concern, contention and conflict related to the minerals sector, forces influencing the processes of continuity and change in the industry, and a number of positive lessons concerning mining and sustainable development that can be drawn from the Papua New Guinea sector.

Part Four concludes by sketching out gaps in knowledge, policy and practice in the sector, and then proposing a number of key areas where further efforts could be concentrated.

Part Two: The Papua New Guinea Minerals Sector

2.1 Introduction

This section of the report aims to provide the broad context pertinent to an understanding of the current context and role of the minerals sector in Papua New Guinea. Given time and resource constraints, what follows is a condensed summary of a large body of literature. If further information is required on specific topics, a number of key references are provided for each section.

2.2 A Brief History of the Papua New Guinea Minerals Sector

The history of modern mining in Papua New Guinea is generally presented as occurring in three waves, each of which is associated with an incremental increase in technologies, scales and the associated economic, social and environmental impacts.

The first of these waves began in 1888, when gold was discovered on Sudest Island in Milne Bay. This sparked a thirty-year progression of alluvial gold exploitation through the islands of Milne Bay (the Woodlark field was the richest), and then into the mainland of what was at that time Papua, under British and subsequently Australian administration. These goldfields brought miners from the Australian goldfields and led to more extensive contact between Europeans and locals than had previous happened. The numbers of miners involved varied from a maximum of 700 at Sudest, to fewer than 100 at places such as Lakekamu in 1909.

These fields were marked by very small-scale operations (usually a single European miner and team of 5-15 local or other Papua New Guinean labourers), low capital requirements, simple sluice box technology, and a short field life. In this context, the goldfields made relatively small positive economic contributions to state revenues, despite official claims. While they had geographically limited social and environmental effects, they did bring far-reaching social and economic changes (in terms of exposing locals to the outside world, introducing new technologies and the like) to some of the affected communities. One of the few lasting economic legacies was small-scale mining by locals in several places after the Europeans had left.

The last of these finds, in 1926, was the fantastically rich Edie Creek field, the high point of the small-scale miner in Papua New Guinea up to that stage. This field then led to the identification and development of the nearby Bulolo valley alluvial gold resource. The development of this extensive resource (described by one of the developers as 'the world's most important placer deposit located since Klondyke' (in Healy 1967:36)) from 1932 by large-scale dredging represented a second wave of mineral exploitation in Papua New Guinea. A small Canadian-based company (Placer Development Ltd) was responsible for the development of this field, through a publicly listed subsidiary, Bulolo Gold Dredging Ltd (BGD). At around the same time large-scale mining interests began mining the hard rock source of the Edie Creek placer deposits, through New Guinea Goldfields Ltd (NGG). Hard-rock mining operations were also developed during the 1920s and 1930s on Misima (gold) and, briefly, at Laloki (copper), just north of Port Moresby.

This phase was marked by capital, technology, labour and impacts significantly greater than the first wave. The initial capital for the operations was raised offshore (largely in Canada and Australia) in public floats, valued at several million pounds in the case of both NGG and BGD. Given the lack of infrastructure and road access to the area at the time, the dredges were broken down and flown in to Bulolo in what was the largest air movement operation of its time. Labour requirements also increased significantly, and BGD itself employed over 1,500 employees by the late 1930s.

Like the first wave of mining, a substantial proportion of the value of the gold produced during this phase was remitted offshore. In 1938, for example, profits accounted for 73% of the value of BGD's production, and in total, between 1932-1962 C$33 million was paid out to the largely Australian and Canadian investors in the company. Despite these offshore flows, mining during this period did make a more substantial contribution to government revenue. It has been estimated, for example, that over the period 1931-1940 mining royalties and duty on imports of mining machinery accounted for 23% of the Territory of New Guinea's revenues. The growth of mining exports, along with a decline in prices for copra – that had previously dominated export trade – saw gold make up between 77-82% of the territory's exports. At more local levels, the consensus is that the economic impact was limited by the low wages paid to labour, the vast bulk of which was indentured labour from other parts of the territory, and a focus on consumption of resources.

The environmental impacts of this phase are not well documented, but the evidence of large areas of productive river flats being converted to 'boulder-strewn wasteland' is still visible today. It has been estimated that the effects of mining waste on the river system extended at least 70km downstream (Hughes and Sullivan 1989:51).

This second wave of mining does provide some examples of the successful transformation of gold mining operations into more sustainable operations. BGD shifted their focus to the local forest resource, and established a successful plywood industry in the area that continues today. This economic activity, along with small-scale mining and a beef operation, allowed for the continued support for the town and its infrastructure, including schools and health facilities.

This phase of mining effectively ended with the Japanese invasion of Papua New Guinea during the Second World War. The mining infrastructure and town was destroyed prior to it falling into Japanese hands. Although BGD re-established its operation in 1948, and subsequently diversified into forestry, gold production never reached the same levels that it had been pre-war, and BGD's dredging operations ended in 1965.

The third, and final wave of mining is usually pegged to the discovery of the large copper/ gold porphyry deposit on Bougainville by Conzinc Riotinto Australia (CRA) geologists in 1963. This was followed soon after by the discovery of the Ok Tedi copper/ gold deposit in 1967 by Kennecott Copper, and the subsequent identification of large ore bodies at Frieda River (year??), the establishment of economically viable gold deposits at Porgera (1981), Misima (1985) and Lihir (1982). Taken together the outcome of this exploration was the development of mines at Panguna (with production beginning in 1972), Ok Tedi (1984), Misima (1989), Porgera (1990) and Lihir (1997). These mines form the core of the current

Papua New Guinea minerals industry. The current state of each of the mines, and the economic, social, political and environmental implications of them, are discussed in the following sections. In terms of relative impacts with the earlier phases of mining, these current mines operate on a scale many orders of magnitude greater than even the Bulolo dredges, involving greater investment, employment, and impacts, as will become obvious below.

A number of critical events have occurred in the industry during this third phase. These include: the renegotiation of the Bougainville Copper Agreement after BCL posted the highest profit recorded on the Sydney stock exchange in 1973; the dispute between the state of Papua New Guinea and Kennecott over the development of the Ok Tedi mine in 1977; the closure of the BCL mine in 1989; the forceful renegotiation by the government of their equity share in the Porgera mine in 1992; armed raids and political interference in the development of the Mt Kare deposit in 1994; the lawsuit against BHP over Ok Tedi's environmental impact between 1994-96 (and currently being revisited); and regular adjustments to the legislation and fiscal regime covering mining throughout the 1990s. These events and issues will be expanded on further below.

Key Sources

Healy 1967, Nelson 1976, O'Faircheallaigh 1982

2.3 The Current Mining Industry in Papua New Guinea

The current mining industry in Papua New Guinea ranks as one of the largest in Asia-Pacific. There are five operating mines, and a vibrant small-scale sector involving up to 50,000 small-scale miners. An indication of the make-up and size of the industry is contained in Table 1 detailing production from each of the mines in 2000.

Mine	Gold		Silver		Copper
	oz	tonnes	oz	tonnes	tonnes
Porgera	910,434	28.318	119,181	3.435	
Lihir	606,035	18.850			
Ok Tedi	533,957	16.608	1,447,844	41.732	203,061
Misima	221,177	6.879	777,997	22.425	
Tolukuma	65,104	2.025	175,857	5.068	
Small-scale*	59,762	1.859	25,317	0.729	
TOTAL	2,396,470	74.538	2,546,196	73.391	203,061

Table 1: Mineral production by mine, Papua New Guinea 2000
(Source: Department of Mining, Quarterly Bulletin, 2000)
Note: *the figure for small-scale mining is the amount of gold and silver exported from rather than produced by the sector.

Current Mining Operations

In this section a brief history of development and notes on the geographic and social setting is provided for each of the current mines, along with an overview of mining and production rates, reserves and mine life.

Porgera

The Porgera gold mine is located in Porgera District, Enga Province. Although exploration at Porgera dates back to the original alluvial gold find in 1939, it was not until the early 1980s that sufficient high-grade ore was identified, and appropriate processing technologies identified, to allow for the development of the current mine. A Special Mining Lease (SML) was issued by the National Government in 1989, and the staged construction started the same year. Production began in late 1990, and in 1992 Porgera's production was over 1.2 million ounces, making it the third largest gold producer in the world. Production has subsequently fallen, in line with the original mine plan, although production in 2000 again peaked at over 900,000 ounces.

The mine is operated by the Porgera Joint Venture, an unincorporated joint venture between Placer Dome (50%), Goldfields (25%), Orogen (20%), and Yuwai No. 65 Ltd (5%). The latter manages equity on behalf of the Porgera landowners and the Enga Provincial Government. The mine has developed in amongst a large (15,000 or more) community within the Porgera valley, and has over 7,000 people living on its 2,227ha SML. A large and on-going commitment is made to Community Affairs, with over 120 employees in this department.

Porgera is located at the western end of the Highlands Highway, 250km west of Mt Hagen. The mine is at an altitude of 2,200m, in an area notable for its steep limestone, unstable terrain, and rainfall averaging over 3,000mm year.

Total ore and waste moved	76.49 Mt
Ore milled	6.02 Mt
Average milling rate	16,452 tonnes per day
Average head grade	5.8g/t gold
Gold Recovery rate	79 per cent
Gold produced	910,434 ounces

Table 2: Porgera production statistics, 2000
(Source: Orogen Minerals Ltd, Annual Report 2000: 36)

It is estimated at this stage that Porgera has another 6 years of mining and a total of 10 years of milling. Proved and probable ore reserves are estimated at 78.5Mt, at an average grade of 3.3g/t gold (with an assumed long-term gold price of US$300 per ounce).

Lihir

Located on Lihir Island, New Ireland Province, the Lihir epithermal gold deposit was discovered in 1982 by Niugini Mining. The subsequent development of the mine was delayed by several years for a range of factors, including the structuring of the developing company, and extended negotiations between local landowners and the state. A SML was issued by the Papua New Guinea government in 1995, construction began in 1996, and production a year later.

The mine is owned by Lihir Gold Ltd. This publicly listed company has as significant shareholders Rio Tinto (16.26%), Orogen Minerals (9.07%), Newmont Mining (9.74%), Battle Mountain Gold Company (9.74%), and Mineral Resources Lihir (6.76%). The mine is operated by Lihir Management Company (LMC), a fully owned subsidiary of Rio Tinto.

Lihir is located approximately 700km northeast of Port Moresby. The island is a volcanic seamount that rises steeply to about 600 meters above sea level. It is roughly oval in shape, being 22km long from north to south and 15km from east to west at its widest points. The island receives approximately 3,700mm rainfall per year. In 1992 Lihir's population was estimated at 5,500 people, but by mid-2000 this was estimated to have increased to over 7,000. An outcome of the protracted negotiations between the community, the state and the mining company was what is regarded as the most sophisticated benefit agreement for the local community. The details of this package and the process by which it was negotiated are discussed below.

Total ore and waste moved	36.115m/t
Ore milled	3.41m/t
Average milling rate	9,300 tpd
Average ore grade	4.22g/t gold
Gold Recovery rate	93 per cent
Gold produced	606,310 oz

Table 3: Lihir production statistics, 2000
(Source: Lihir Gold Ltd, Annual Report 2000: 36)

Proved and probable reserves at Lihir are estimated at 108.8Mt, at an average grade of 3.65g/t gold (with an assumed long-term gold price of US$300 per ounce). These reserves are estimated to provide another 14 years of mining, and an additional 17 years of processing of stockpiled material, giving a total mine life of 31 years (Lihir Gold Ltd 2000:3).

Ok Tedi

Located in North Fly District, Western province, the Ok Tedi deposit was first discovered in 1969. Originally explored and developed to feasibility stage by Kennecott, the company withdrew from negotiations with the government in 1975. The deposit was subsequently developed by Ok Tedi Mining Limited (OTML), a company managed and currently 52% owned by BHP, with the Papua New Guinea state holding 30% (15% in its own right, 2.5%

on behalf of local landowners, and 12.5% on behalf of the people of Western Province) and Canadian miner Inmet holding the remaining 18%.

Construction began in 1981, and production of gold in 1984. The mine has had a controversial and chequered history, for a range of operational, financial and environmental reasons. It ran over budget during construction, and then lost money consistently for the first 10 years of its operating life. There was a dispute between the state and OTML in 1987, with concern that the company would not proceed to the copper processing. At around the same time, concerns about the environmental impact of tailing and waste rock on the Ok Tedi and Fly river systems grew, culminating with a high profile lawsuit against BHP in Melbourne, Australia, between 1994-1996. A settlement reached in 1996 provided for a range of compensation arrangements for affected communities (although these were not directly the result of the lawsuit), and a commitment by BHP to implement a feasible tailings containment option as soon as practicable (Banks and Ballard 1997). The environmental aspects of the operation are discussed further below.

In 2001 court action resumed with claims that BHP had not adhered to the terms of the settlement. In August of this year the newly merged BHP Billiton wrote off its remaining US$148 million investment in the project. Most recently, BHP Billiton announced that they are to withdraw from the project, although the precise terms of this withdrawal are not available at the time of writing. It is known that under the Heads of Agreement, BHP Billiton will transfer its 52% interest in the project to an offshore trust company that will hold the equity on behalf of the Papua New Guinea government, Western Province and affected landowners.

The Ok Tedi mine is located in Star Mountains in the north-western corner of Western Province, 18km from the Irian Jaya border. The area is rugged and steep, and subject to rainfall of up to 10m per year at the mine site. The area is drained by the Ok Tedi river, that flows for approximately 150km to the junction with the Fly River, that then flows a further 500km to the Gulf of Papua.

The mine development has required the establishment of extensive infrastructure in an area where previously very little existed. This includes a town at Tabubil, with a current population of approximately 10,000, an airstrip at Tabubil, community health services in and around the mine, and a road to Kiunga. The recovered copper, gold and silver is pumped down a pipeline as concentrate to Kiunga, where it is dried and loaded onto barges for transhipment down the Fly River.

The local population around the minesite is relatively small (1,500), but much larger populations have been affected by the mine to the north (where there have been inflows of money from wages and other payments) and to the south (where up to 30,000 people along the Ok Tedi and Fly River systems have been adversely affected by the environmental impact of the mine). The most seriously affected population downstream are the Yonggom, a language and cultural group of around 4,500 living in the Lower Ok Tedi area.

Total ore and waste moved	44.97 Mt
Ore milled	15,657 Mt
Average milling rate	85,000 tpd
Average head grade	0.88g/t gold
	0.92% copper
Recovery rate	61.6% gold
	76.3% copper
Production	533,957 oz gold
	1,447,844 oz silver
	203,061 tonnes copper

Table 4: Ok Tedi production statistics, 2000
(Source: Department of Mining, Quarterly Bulletin, 2000)

Proved and probable reserves in 1998 were 344Mt at an average grade of 0.88% copper and 0.92g/t gold. It is estimated that with these reserves the mine has another 10 years of operations.

Misima

Misima Island is located in the Louisiade Archipelago, approximately 650 kilometres east of Port Moresby in Milne Bay Province. As noted earlier, Misima was the site of a 19th century goldfield, and small-scale mining by locals continued after the withdrawal of the European miners. From 1915 there was significant underground production from the Umuna mine on the island. This ended in 1942 due to World War II. Post-war, more limited production resumed, although this ended in 1959. Placer (PNG) Pty Ltd began exploring again in 1977, and in 1987 the Papua New Guinea government approved the development of the gold and silver deposit. Construction began in 1988 and production in 1989. Misima Mines Pty Ltd owns the mine. Placer Dome has a 80% shareholding in Misima Mines, and Orogen Minerals hold the remaining 20%.

Misima Island is 39 kilometres long by three to nine kilometres wide, and reaches 1035 metres towards the western end of the island. Average annual rainfall is around 3,500mm. The island is located within the tropical cyclone belt and has experienced eight cyclones since 1922. The population of the island is around 14,000, spread in villages around the coast. The society is matrilineal, and the status of women is high as they were centrally involved in the allocation of land rights and subsistence production, particularly for the mortuary feasts that dominated rituals on the island. Despite the long history of alluvial and hard rock mining on the island, the overwhelming majority of Misimans were subsistence gardeners, with yams the staple, prior to the arrival of Placer Dome.

Total ore and waste moved	24.66 Mt
Ore milled	6.09 Mt
Average milling rate	16,630tpd
Average head grade	1.22g/t gold
Gold Recovery rate	91%
Gold Produced	217,760 oz

Table 5: Misima production statistics, 2000
(Source: Orogen Minerals Ltd, Annual Report 2000: 36)

It is estimated at this stage that Misima will finish mining in 2001, with the processing of low-grade stockpiles to continue for another four years. Proved and probable ore reserves are estimated at 18.1Mt, at an average grade of 0.9g/t gold (with an assumed long-term gold price of US$300 per ounce).

Tolukuma

The Tolukuma mine site is located about 100 kilometres north of Port Moresby in the Fane District of Central Province. The initial exploration that identified the deposit was carried out by Newmont Pty Ltd, and purchased in 1993 by Dome Resources. Construction began in 1994, with open pit mining beginning the following year. Underground production commenced in 1998. The mine is owned and operated by Dome Resources, an Australian listed company 97% owned by the South African Durban Roodepoort Deep Ltd.

Access from Port Moresby to Tolukuma is by air, either directly by chartered helicopter, or by fixed wing aircraft to the bush airstrips at Fane mission, about six kilometres to the west, or to Woitape, about 12 kilometres to the east.

Ore milled	110,000t
Average milling rate	approx 300 tpd
Average head grade	19.4g/t gold*
Gold Recovery rate	89%
Production	65,104 oz gold
	175,857 oz silver

Table 6: Tolukuma production statistics, 2000
(Source: Department of Mining, Quarterly Bulletin, 2000: 75, Dome Resources Quarterly reports)
For September-December 2000

Total mine resources as at 30 June 2000 were 570,000t at 25g/t gold and 90g/t silver. The mine is expected to operate until 2005 on existing reserves.

Small-Scale Mining

The small scale mining sector is increasingly being recognised as a significant contributor to gold production and, more importantly, livelihoods, across at least 10 provinces in Papua New Guinea (including Morobe, Milne Bay, Eastern Highlands Gulf, Northern, East Sepik,

North Solomons and Enga). Wau/Bulolo and the Sepik area are the two largest current areas of alluvial mining. In many cases these are areas that have been mined earlier, but still contain a sufficient resource to keep small-scale producers viable.

The small-scale mining sector has considerable economic impact. Department of Mining and Papua New Guinea Chamber of Mines and Petroleum (PNGCMP) estimates are that the sector produces over K100 million in gold and silver per year, with high end estimates placing production closer to K150 mllion, or over 1% of GNP. In recent years events such as the Mt Kare rush saw production from this sector rise significantly. In 2000, almost 60,000 ounces of gold and 25,000 ounces of silver from the sector were formally exported, but it is widely acknowledged that up to 50% of production is not formally recorded.

It has been conservatively estimated recently that at least 50,000 people are directly involved in small-scale mining, with women, children and youth making up 35% of this total. It has been estimated that average earnings are in the order of K250 per month. Another 50,000 people are estimated to be less directly involved in the industry, and it supports at least 150,000 people.

Exploration

The following brief notes are simply intended to provide a sense of the history, location and current knowledge of the size of the main current exploration targets. Further details on each of these are available in the Mines Division Quarterly Reports, Department of Mining.

Ramu Nickel

The Ramu project, located on the Ramu River in Madang Province, is a joint venture between Highlands Pacific (68.5%) and Orogen Minerals (31.5%). The occurrence of nickel-cobolt in the area was first identified in 1962, although subsequent exploration over the next 30 years failed to prove up an economic resource.

After several years of negotiation a Mine Development Contract (MDC) was signed in July 2000 and SML granted at this time. A series of Memorandum of Agreement (MOA) defining the distribution of benefits from the project between landowners, Provincial and Local-Level Governments (LLG) were subsequently signed in November 2000. The project is currently on hold while Highlands Pacific seek a major equity partner and manager for the project. It is projected that development costs will be in the order of US$838million. The design autoclave throughput is 3.2 Mt of ore per annum, and production is estimated to be 32,800t of LME Grade 1 cathode nickel and 3,200t of cobolt as cathode. The reserves are estimated to support a minimum 20 year mine life.

Estimated Resource (tonnes)	Grade (Ni%)	Grade (Co%)
143,200,000	1.01:	0.10
Estimated Reserve (tonnes)	Grade (Ni%)	Grade (Co%)
75.7	0.91	0.10

Kainantu

Located in an area of historical gold mining in the Eastern Highlands province, the Kainantu gold prospect is currently regarded as a small, high-grade deposit. The prospect is being actively explored by a company called Ramu Nickel Ltd. Ownership is split 65% Highlands Pacific Resources and 35% Nippon Mining and Metals Co Ltd. Nippon have an option to acquire up to 50% of the company by sole funding further exploration.

Reserves (December 2000)

Estimated Resource (tonnes)	Grade (g/t Au)	Contained Gold (ounces)
886,000	28.3	805,600

Hidden Valley/ Hamata

Located near Wau in Morobe Provice, this project covers a series of epithermal gold deposits that have been the subject of exploration for over 20 years, in an area that was an early focus for both large and small-scale mining. The project has had a series of managers and owners over this period. It is currently managed by Aurora, who own 50%, along with CDC Financial Services (45%) and Kula Fund Limited (5%).

Resource Estimates

Total Estimated Resource (tonnes)	Grade (g/t Au)	Contained Gold (ounces)
79,100,000	2.0	4,500,000

Wafi

The Wafi deposit in Morobe Province is located approximately 40km southwest of Lae. It comprises a combination of epithermal gold mineralisation distributed around a porphyry gold copper mineralised intrusive. In July of this year Aurora Gold Ltd took up an option to acquire 100% of the exploration tenements from Rio Tinto.

Resource Estimates

The various epithermal gold deposits are estimated to comprise around 26Mt with over 5.5 million contained ounces (at a cutoff of 0.5 g/t). Resource estimates for the porphyry copper gold deposit are given below.

Estimated Resource (Mt)	Gold (g/t Au)	Copper (%)
100	0.6	1.3

Frieda/ Nena

The Frieda/ Nena deposits in Sandaun Province were first identified in the late 1960s, and have been the subject of investigations by a variety of corporate explorers over the years. The prospect is currently owned (87.9%) and managed by Highlands Pacific, with OMRD Frieda Ltd (a Japanese consortium headed by Sumitomo Metal Mining) the other equity partner. The prospect is a series of distinct large porphyry copper gold systems that are estimated to collectively contain approximately 5.8 million tonnes (12.8 million pounds) of copper and 11.4 million ounces of gold.

Resource Estimates

Because the different prospects have had different exploration histories, the reporting of resource estimates has also varied. The total inferred resources for the Koki, Ok Nerenere, Ekwai, and Horse-Ivaal systems are given below.

Total Inferred Resource (Mt)	Gold Grade (g/t Au)	Copper Grade (%)
877	0.25	0.45

The Nena deposit has been the most extensively explored and the mineral resource estimate (cut off grade 0.25% Cu and 0.6 g/t Au) for this is given below.

	Total Estimated Resource (Mt)	Gold (g/t Au)	Copper (%)
Gold	14.5	1.4	0.1
Copper	60.1	0.6	2.0

General Comments

In terms of mineral wealth contributing to the economy and society of Papua New Guinea in the medium to long-term, one of the most significant concerns is the rapid decline in exploration expenditure within the country. Figure 2 shows the amount of exploration expenditure since 1987.

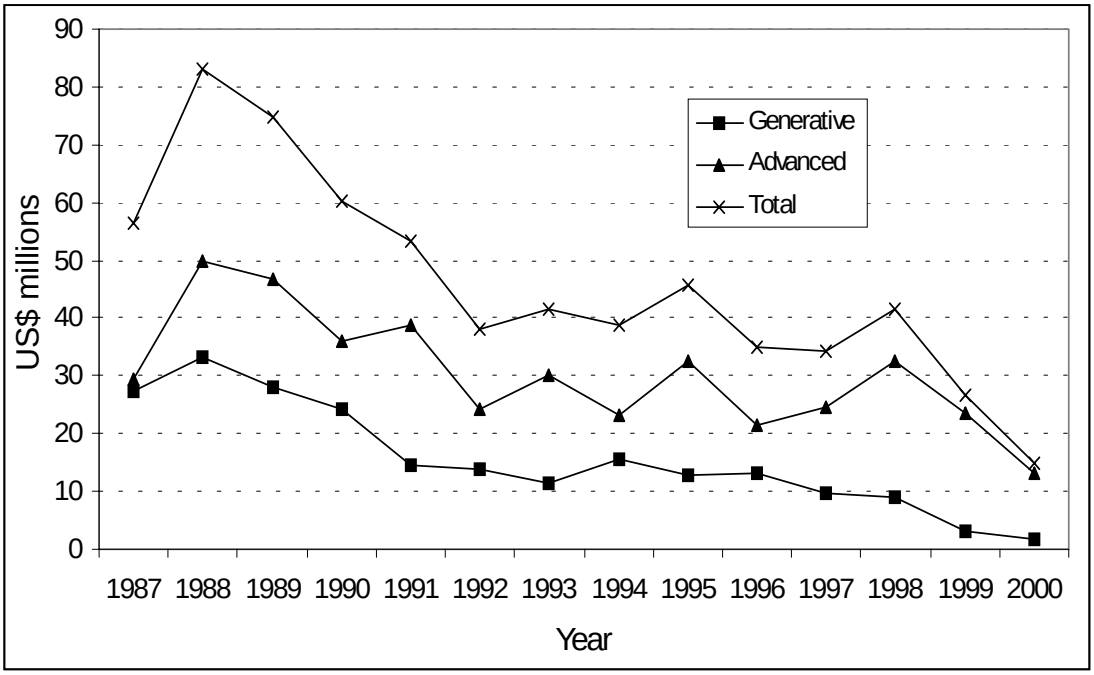

Figure 2: Exploration Expenditure, 1987-2000, US$
(Source: Mining Division Quarterly Report December 2000: 33)

In 2001 exploration expenditure is expected to be US$12.9 million, with the bulk of this coming from two advanced prospects (Kainantu, US$5.2 million, and Hidden Valley/ Hamata, US$5.0 million), and just US$1.3 million being spent on generative exploration.

Figure 3 shows the number of ELs by year since 1987. Two additional comments can be made on these figures. First, many of the current ELs are inactive, and a proportion are expected to either be cancelled for not meeting the conditions of the licence, or relinquished by the licensee during 2001. The PNGCMP anticipates that following this process, there will be 80 current ELs by the end of the year, the lowest number since the early 1980s. Second, when the number of applications for new ELs is shown, the decline in exploration interest in Papua New Guinea is even more marked (Table 7).

Year	Number of new Exploration Licence Applications
1997	56
1998	14
1999	15
2000	10
2001 (to May)	2

Table 7: New Exploration Licence applications lodged, 1997-2001
(Source: PNGCMP, 2001:14)

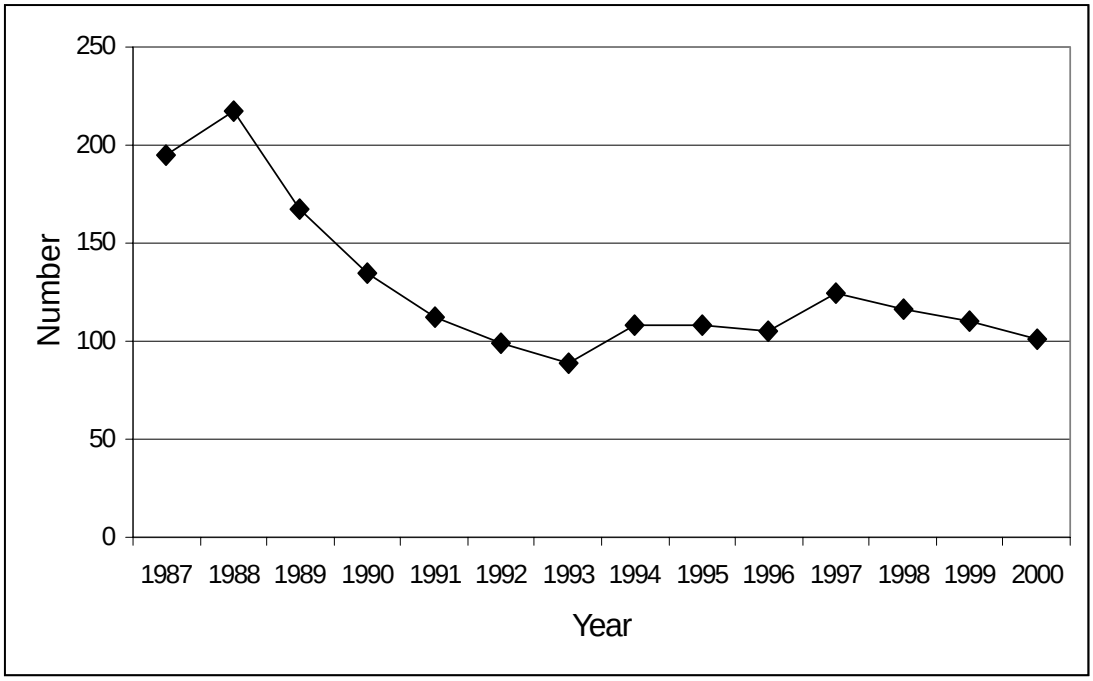

Figure 3: Exploration Licences Valid at Year End, 1987-2000
(Source: Mining Division, Quarterly Report, December 2000:33)

Of particular concern is the absence of the large, reputable mining houses. BHP have withdrawn from all exploration, mining and petroleum projects in Papua New Guinea except Ok Tedi, and they are in the process of negotiating with the state of Papua New Guinea and other stakeholders the terms of their exit from this project. Rio Tinto have agreed to sell Wafi, leaving them with just the management of and 17% equity in Lihir as their only interest in the country. Placer Dome have no plans for further exploration except in and immediately around their existing operations at Porgera. No other large mining house has any current interest in the Papua New Guinea minerals sector. This issue is discussed further in Section 3.2.

Stakeholders

In the current minerals sector, a range of key stakeholders can be identified. Each of these is briefly introduced here so as to give a sense of the range of issues that are addressed below. As will become clear, the different stakeholders often have very different interests in the sector, and different priorities in terms of bringing change to the industry.

Mining Corporations

Foreign-owned mining corporations dominate the current mining sector. These include Placer Dome, Rio Tinto and, until recently, BHP. While the primary interests of these entities is financial, and specifically profit maximisation, recent initiatives within the industry (including MMSD) reveal a range of other motivations aimed at ensuring the longer-term future of the industry. In terms of the spread of interests, the larger multinational miners are publicly listed corporations, and institutional investors in Australia, England and Canada, particularly superannuation funds, dominate their shareholding.

The National Government

The National Government in Papua New Guinea is the policy maker for the industry, its regulator, a major financial beneficiary, and a part owner of a number of the mine operations. This range of interests can lead to conflicts of interest, which are often played out through inter-departmental politics. The history of such disputes shows that the financial interests of the government have tended to take priority over local or environmental agendas. One other factor at the national level is that individual politicians have from time to time played a leading role in initiating new policy directions, pursuing nationalistic or personal agendas.

Local Communities

Local communities, while always involved in or impacted on by mining in Papua New Guinea, came to prominence as stakeholders in the Papua New Guinea minerals sector in the late 1980s. This period was marked both by the beginnings of the 'minerals boom' and the closure of the BCL mine. The two events meant that local communities became engaged in negotiations and discussions to a far larger extent than they had previously. The Mining Act 1992 enshrined this participation in legislation, and subsequent developments have seen communities become major economic beneficiaries of large-scale mines. As discussed below, the role of communities as stakeholders also extends to bearing the brunt of the social, cultural and environmental changes that the mines bring. The Ok Tedi and Porgera cases discussed below have extended the definition of affected communities to include those away from the immediate mine site, particularly downstream communities impacted by waste disposal practices.

Provincial Governments

Provincial governments have been major financial beneficiaries of large mining developments. The Enga Provincial Government (EPG), for example has received over K46 million in royalties from the Porgera mine from 1990-2000. Other revenue flows include a Special Support Grant (SSG) paid by the national government in lieu of royalties diverted to landowners and, from 1995, provincial taxes. Provincial governments have also been involved in the implementation of Tax Credit Scheme infrastructure projects, discussed below. While they have benefited in economic terms, the Provincial governments have had little role in the day-to-day administration of government at each of the mine operations. Salaries of provincial public servants are paid (albeit often late and seemingly grudgingly), but because all of the major mines are distant from the respective Provincial capitals, and the communities are seen as receiving benefits well in excess of other parts of the province, the involvement of Provincial Governments in the administration of the area has tended to be ephemeral and often politically driven.

Local Level Government (LLG) and Institutions

Major changes to the role and structure of Provincial governments in 1995 saw the devolution of responsibilities in a range of administrative fields to LLG. In most parts of the

country this has had little positive effect due to a lack of resources to support this devolution, but in areas around the existing large mine operations the potential to develop effective local government is starting to be realised. The interests of LLGs in the mines varies but can include revenue from the mines, support for the implementation of structures and practices for good governance from the mining company, and assistance in longer-term ('sustainability') planning.

The broader Papua New Guinea Community

The broader Papua New Guinea community has an interest in seeing the country's mineral wealth translated into broad-based development. As is discussed in the following section, this has not happened. A further tension discussed below is the balancing of broader development objectives against the localised demands of impacted communities.

Employees (Local, National and International)

This stakeholder group has a set of fairly well defined objectives, namely secure employment, safe working conditions, adequate wages, training and development of skills. The extent to which each of these applies to each individual employee will vary depending on factors such as whether they are a local, national or expatriate employee (the expatriate employee will, as a rule, be more concerned with monetary returns than the other factors), the employees level of education and training, and the extent of their links with particular locations (local employees may have less interest in continuing with a career in mining once the mine in their place is closed). The professional and skilled mining labour force of Papua New Guineans that has developed over the last 30 years also has an interest in seeing the continuation of the industry within the country.

Non-Governmental Organisations (NGOs) (National and International)

Civil society movements in Papua New Guinea are relatively new. Domestic environmental and community and human rights NGOs became established in Papua New Guinea from the early 1990s, building in part on the greater presence of international NGOs in the country following the 1992 Rio Earth Summit. Given their limited resources, most are still establishing their place and credibility within the country. Their interests as articulated in their literature are primarily environmental and community rights: indeed their work often stresses the relationships between these two facets. Their presence is fostered by collaborations and support from international NGOs, particularly environmental NGOs such as Greenpeace, World Wide Fund for Nature, and Conservation International. In the mining arena the most influential international NGO in Papua New Guinea has been the Mineral Policy Institute (MPI) established in Sydney in 1995. The interests of MPI, as an example of an international NGO, include a specific reference to addressing 'the impacts of Australian minerals companies in the Asia Pacific region' by supporting communities requesting information and assistance, preventing development of undesirable mining projects and promoting good mine and mineral sector management.

Suppliers (local, national and international)

A range of local, national and international businesses are suppliers of goods and services to the sector. For most international suppliers, the Papua New Guinea sector is a relatively small part of their international or Australian business. Because of preferential treatment under existing mineral policy, many of the local suppliers would not be competitive in an open market. One implication of this is that these local suppliers will not be able to survive beyond the life of their respective mine. Likewise the relative lack of other manufacturing or industry in Papua New Guinea limits the extent to which national suppliers are able to diversify, and their business prospects are heavily dependent on the continued health of the minerals sector.

Sources

Burke 2001, DoM 2000.

2.4 Economic Issues

The minerals industry has been a critical component of the formal economy of Papua New Guinea for the last 30 years. This section will outline the extent of this contribution at the national level using a range of standard measures, then discuss the issue of mechanisms for management of mineral revenues at the national level. The evidence from the Papua New Guinea case for the notion of a "resource curse" will be briefly touched on, and the section will conclude with a description of employment issues at the national level.

Formal measures

In terms of the contribution of minerals to the economy of Papua New Guinea, a number of aspects can be noted. Perhaps most significantly, minerals have formed a significant proportion of Papua New Guinea's exports since 1972 (see Figure 4). In total, during the period from 1972-2000, gold, silver and copper worth K21.5 billion have been exported, making up 47% of total exports over this period. In 2000, this figure was 2.57 billion, or 46%. It should be noted that the relative decline of the importance of mineral exports since the early 1990s is attributable to the initiation of oil production and the rapid increase in log exports. Both oil and logging pose similar sets of governance issues to the minerals sector discussed below.

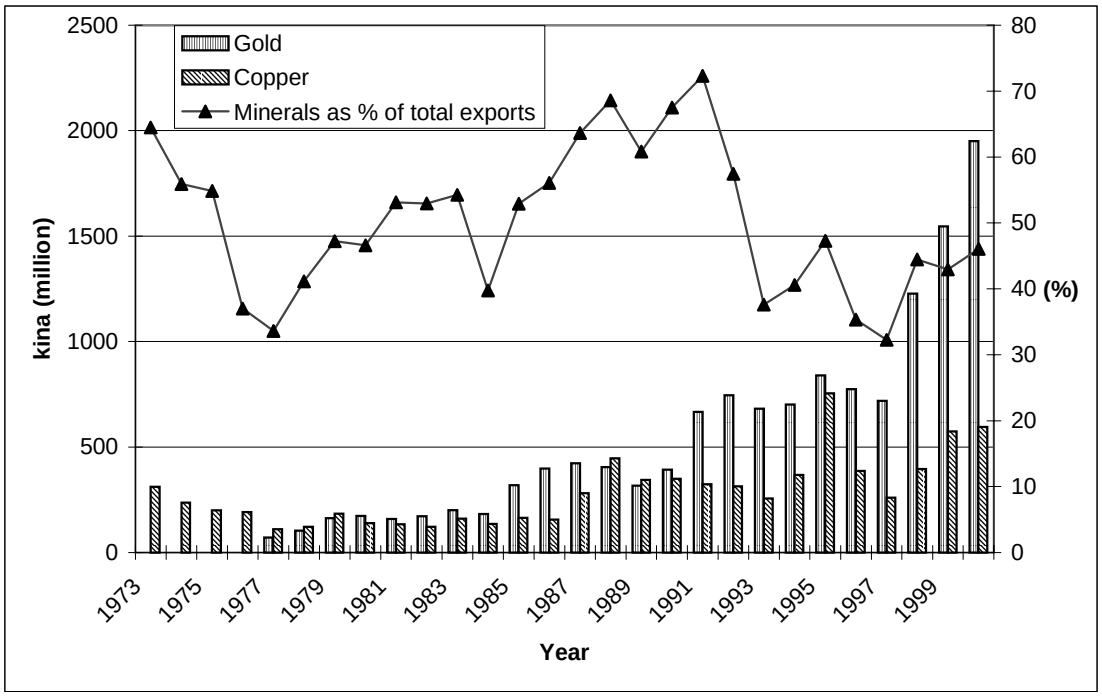

Figure 4: Exports of minerals, by value, 1973-2000
(Source: BPNG Quarterly Economic Bulletin, various years)

Two other points to note are that the kina values of exports have been affected by two key influences during the last decade in particular. The first of these is the depreciation of the Papua New Guinea Kina, particularly since 1994. Over the period 1990-2000, the value of the kina fell from US$1.05 to US$0.36. The implication of this is that while Figure 4 indicates a rapid growth (from K719 million to K1951 million: a 2.6-fold increase) in gold exports since 1997, this is not the case. Volumes of exports of gold and copper are shown below in Figure 5, and illustrate that while there has been some increase since 1997 (44t to 73t in 2000), it is the depreciation of the kina over this same period that accounts for the bulk of the increase in the value of exports. In particular this more than compensates for the decline in gold prices in the period since the 1980s. In real terms, then, the value of gold exports has actually declined since the early 1990s.

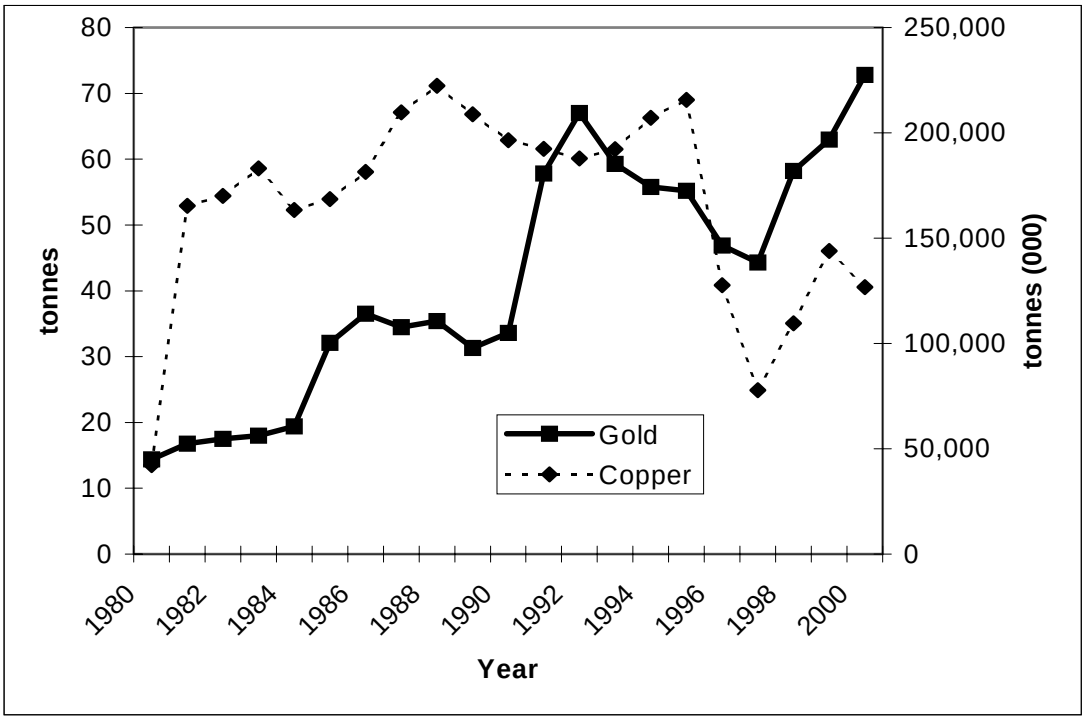

Figure 5: Mineral Export Volumes, 1980-2000
(Source: BPNG Quarterly Economic Bulletin, various years)

In terms of other measures, the minerals sector has directly contributed between 10% (1984, 1997) and 31% (1973-74) of GDP over the period 1972-2000. This proportion has varied over the period, with no obvious trend. Throughout the 1990s, this figure remained between 10-17%. The minerals sector currently comprises around 40% of all foreign investment in Papua New Guinea. On an annual basis, mining investments comprised around 50% of foreign direct investment flows in the early and late 1980s, as each new mine required significant capital inflows over a period of several years. Although dwarfed by the capital flows associated with the petroleum sector in the 1990s, mining investment remained a significant component of total flows, and comprises up to 10% of GDP.

Despite often being referred to as economic enclaves, there are significant economic linkages between the mines and the rest of the Papua New Guinea economy. The Porgera mine, for example, has awarded K466 million in operations contracts to Papua New Guinean contractors since 1990. This represents over 70% of the total value of contracts issued during this period. In 2000 the purchase of Porgeran, Engan and other Papua New Guinean businesses and services by the PJV was valued at K246 million. At Ok Tedi, purchases of goods have averaged K168 million per year since 1989, of which 53% were purchased in Papua New Guinea. In 1998, OTML issued contracts for works and services worth K108 million to Papua New Guinea registered companies, over half of whom were from the local area. At Lihir contracts and casual work worth K20 million were purchased from local businesses by LMC during 2000.

Government Revenues

In terms of a contribution to government revenue and assets, the minerals sector again has played an important role. In terms of this contribution, four main benefit streams can be distinguished: direct taxes and royalties, import duties, income taxes from employees, and dividends and equity.

The fiscal regime that operates in Papua New Guinea has evolved from a model first put in place in the 1974 renegotiation of the Bougainville Copper Agreement. The key elements of this regime are outlined in the following section. In 1974 a Mineral Resources Stabilisation Fund (MRSF) was established by legislation to receive all taxation and dividend revenues from the industry. The intention was to provide a buffer for the government from shocks induced by changing global commodity prices and variations in output. The maximum drawdowns that the state could make from the fund in any one year were governed by a set of regulations relating to the level of payments in past years and anticipated revenues.

A total of K814 million was paid in taxation and dividends (and some other minor payments) by mining companies into the MRSF over the period 1976-1992. With the onset of petroleum production, taxation from the petroleum producers was also directed into the MRSF. Since 1992 an additional K2.7 billion has been paid into the MRSF. On the basis of the publicly available information, it is not possible to determine precisely the relative contribution of the petroleum and hard-rock minerals sectors to the MRSF in the post-1992 period. It appears that taxation from the petroleum sector made up two thirds of the revenues collected. This would mean that the hard-rock minerals operations contributed around K900 million to the MRSF from 1993-2000. In many respects, though, the exact amounts paid into the fund by mining and petroleum are less significant than the way in which the fund has been managed.

In 1986 changes were made to the draw down limits from the MRSF, ostensibly to provide the Board of the MRSF with greater flexibility in terms of the amounts transferred to the public account. One subsequent outcome of this was despite a rapid build-up in the end of year balance of the fund during the mid-1990s, in 1998 draw downs exceeded the payments to the fund, something that had not been possible originally. In 1998, the draw down from the MRSF to the public account (K330.1 million) comprised 18% of the government's internal revenue. In 1999 a decision was made to draw down the entire remaining balance of the fund (a total of almost K1 billion) to cope with a serious domestic public debt issue. Following from this was the decision to repeal the MRSF legislation, which was effective from December 2000.

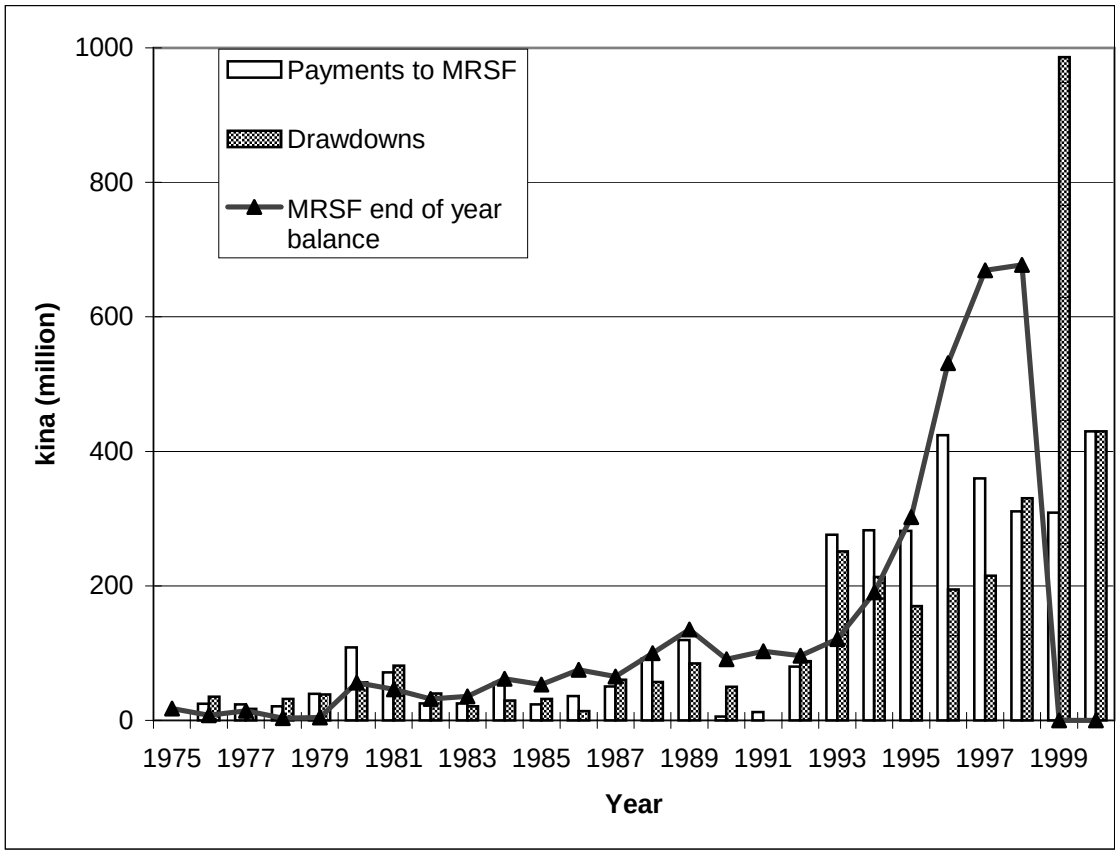

Figure 6: The MRSF 1975-2000
(Source: BPNG Quarterly Economic Bulletin, various years)

One other measure of the contribution of the mineral sector to development in Papua New Guinea to consider is the proportion of the value of mineral exports that the government has been able to capture. As Figure 7 shows, the taxation captured by the government (as measured by payments to the MRSF) represents 9% of the total mineral export value for the period 1976-1992. In the period since 1992, with petroleum producers also contributing, the figure rises to 14% of the total value of minerals and oil exported over this period being captured by the government through tax. Such a calculation is slightly misleading, as there is a lag between the products being exported and the companies paying taxes on their net revenues. In 1997, for example, a higher level of payments to the MRSF for revenues earned in 1996 corresponds with a lower level of exports due to the 1997-98 El Niño event (which affected production at Porgera and Ok Tedi). Despite this, Figure 7 does illustrate that the Papua New Guinea state has been able to directly capture just over 10% of the value of mineral exports through its fiscal regime over the full period from 1973-2000.

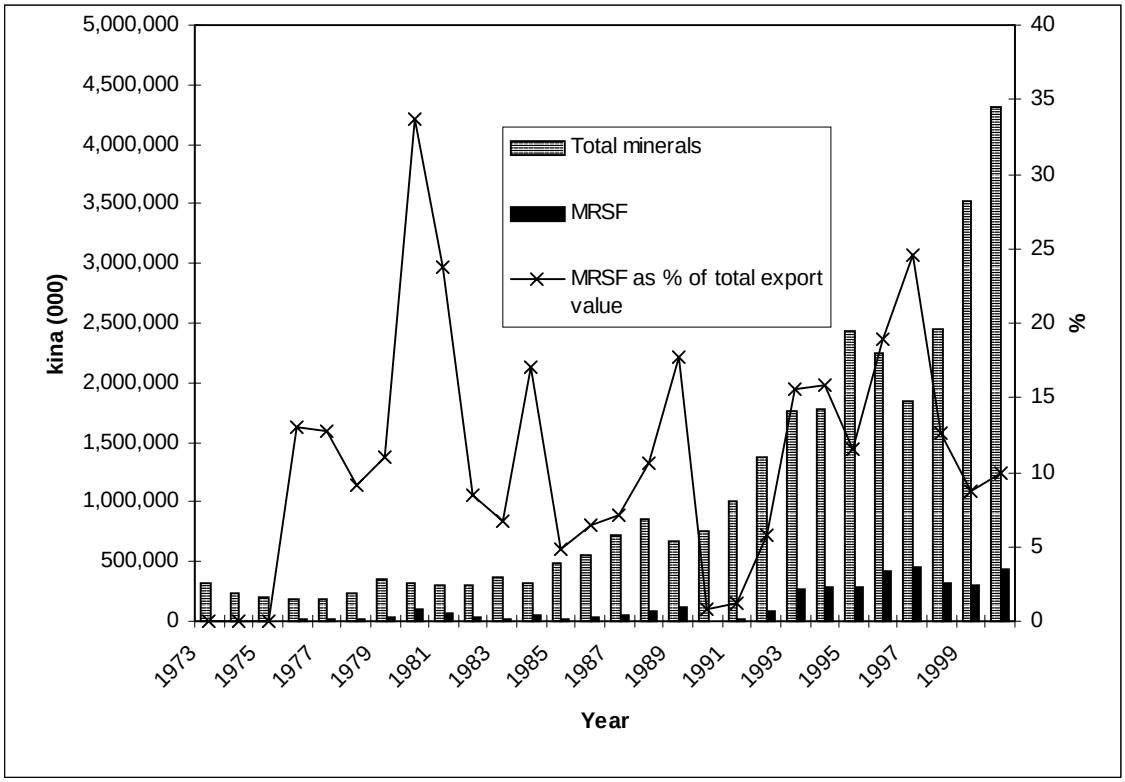

Figure 7: Mineral export values and MRSF receipts, 1975-2000
(Source: BPNG Quarterly Economic Bulletin, various years)

In addition to direct taxation of the mining companies, the sector also generates significant taxation revenues from income taxes on employees and, until 1998 at least, significant import duties. While industry-wide figures on these contributions are not available, some data are available from some of the individual mines. OTML employees in 1998 paid K20.2 million in income tax, for example. This represented around 5% of total Papua New Guinea personal income taxes paid for the year. Figures from the PJV indicate that in 2000, employee's income taxes totalled K20 million, customs duties (including the mining levy, discussed below) K23.6 million and a fuel and excise tax K3.8 million. To give a sense of the relative contribution of this, direct corporate income tax paid by the PJV in 2000 was K35.1 million. Over the life of the mine, the PJV has paid a total of K456 million in corporate income taxes and the company and its employees have paid another K220 million in other taxes, levies and duties. In other words, these additional taxes and duties make a significant contribution to government revenues, although they are not paid through the MRSF.

One other significant, and controversial, economic issue at the national level has been the acquisition of equity by the state in the large-scale mining sector. By legislation the state has a right to acquire 30% in each mining operation at the time of the grant of a SML. The stake in particular mining operations has varied – from 20% in Bougainville and Misima, to an initial 10% in Porgera (controversially renegotiated to 25% in 1992) and an eventual stake of just 9% in Lihir. The state equity holdings was held and managed by the Mineral Resources Development Corporation (MRDC). In 1996 a partial privatisation of the state's mineral and petroleum assets was carried out with the public float of Orogen Minerals, a publicly-listed company with a 51% MRDC shareholding. Not all state-held equity was included in

the Orogen float, with the Ok Tedi and Bougainville shareholdings excluded. The float raised $A260 million for the Papua New Guinea government. Since then Orogen has increased the value of its net assets, to the point where these are worth US$426 million. In 2000, the company made an after tax profit of US$68.3 million, as well as paying US$44 million in taxes in Papua New Guinea.

Despite the partial privatisation of the state equity, the issue remains controversial. It has been argued that the benefits associated with state shareholding in the large-scale mines (some economic returns, access to management expertise, less pressure to tax industry more heavily, and supporting nationalistic sentiment) have not been sufficient to outweigh the costs (possible economic loss, conflicts with regulatory role, disincentive to investment, and tying up of state assets). In recent years the consensus among corporate and government officials in Papua New Guinea appears to be that the issue is not so much equity or no equity, but rather the appropriate level of equity in particular projects.

Employment

One final national-level economic issue is employment. Because of the capital intensive nature of the mines, employment has been low in terms of the total Papua New Guinea labour force. With a total direct employment of less than 6,000, the industry accounts for less than 5% of the total formal labour force in Papua New Guinea. Within the workforce, the bulk of the employees are Papua New Guinean. Of OTML's 1900 employees, for example, around 90% are Papua New Guinean. The relatively small proportion of expatriates fill the bulk of the professional and highly skilled positions. Conditions and wages for the Papua New Guinean workforce are generally good, and certainly compare very favourably with public service positions. This in itself has created a problem, with the private sector often attracting the more skilled and capable public servants away from government positions. This has contributed to a decline in government capacity, an issue developed below. Training and localisation programs are a requirement of National legislation, and the training schemes in place at the larger mines are effective at providing a range of technical and professional skills to Papua New Guinean employees. This has been the case since the establishment of BCL, which operated a very highly regarded training programme. Occupational health and safety at the various mines compares very well with Australian and Canadian levels. Under Papua New Guinea law, workers enjoy a freedom of association in terms of union membership. Industrial disputes have been relatively rare, although on more than one occasion industrial action has ended in violence. Non-local mine employees generally work on Fly-In, Fly-Out (FIFO) rosters and stay in separate mine accommodation, reducing their interactions with the local community. This has been a source of controversy, particularly at Porgera where the local community see this practice as draining economic resources out of the area.

Sources

Auty 1993, Burke 2001, Daniel 1985, Jackson 1994, McGavin 1993, Tilton et al 1986, Hancock 1997.

2.5 The Current Regulatory and Policy Framework

In this section broad policy issues are discussed, then the major elements of the legislative framework that impinge on the minerals sector are laid out, before discussing in more detail the fiscal regime under which mining companies operate.

Papua New Guinea's current minerals sector policy is still largely based on policy developed in the immediate post-Independence years. The key features are:

- State ownership of minerals;
- The utilisation of foreign investment for the development of mineral deposits due to very limited internal capital, technology and expertise;
- A focus on extracting government revenue from the sector and then employing these funds for broader economic development within the country, although as noted above this component of the policy has largely failed.

It is this latter failure that has given impetus to changes, often de-facto, in the last decade. While these are changes in practice rather than stated policy, their implications have been to undermine or make largely irrelevant the existing policy. Several of these shifts have been fundamental to the current challenges that the sector faces and will be discussed at length below. The key changes in the state's approach to the exploitation of mineral resources in the past decade have included:

- Greater emphasis on the involvement of local communities in the mineral development process;
- A marked shift in the distribution of revenue flows from mining operations from central government to local communities and institutions;
- The de-facto surrender of state sovereignty over mineral resources with the payment of the full value of royalties from the sector to local communities and provincial institutions

In terms of regulatory framework, the main current piece of legislation under which the industry operates is the Mining Act, 1992. This states in Section 5 that:

> *all minerals existing on, in or below the surface of any land in Papua New Guinea, including any minerals contained in any water lying on any land in Papua New Guinea are the property of the State and that all leases and licenses for leases subjects of mining areas are made pursuant to the Mining Act.*

The Act goes on to cover issues such as royalties payable to the State as the owner of the resource, the principles for compensation, the process for acquiring different types of mining and other leases (Mining lease, Special Mining Lease, Alluvial Mining Lease, Lease for Mining Purposes etc), and the use of the Development Forum process.

Other Acts that directly impinge on, or shape the impacts of, mining operations are the:

- Minerals Resources Development Company Pty Ltd Privatisation Act, 1996 that covers the State's right, through MRDC or Orogen Minerals, to acquire a 30% interest (at sunk cost of exploration) in mining development projects in Papua New Guinea.

- Mining (Safety) Act (Chapter 195A) that governs issues such as safety inspections of mines, regulation of mine management, supervision and conditions of employment, all the responsibility of the Chief Inspector of Mines.

- The Organic Law on Provincial Governments and Local-Level Governments, that came into effect in 1995, requires, under Section 98, the payment of royalties, compensation and other benefits to project landowners. Further, there is a range of levys that new projects are required to pay to Provincial and Local-level governments for infrastructure and community development. Sections 115 and 116 provide for, and outline the form of, consultation and liaison that is required by National, Provincial and Local-level governments with local landowners, including development forums.

In terms of the environmental legislation that governs mining operations, a new Environment Act has recently been passed by Parliament, but has not yet been enacted. Hence at the present time mining operations (with the exception of Ok Tedi) are still subject to the following:

- Environmental Planning Act (Chapter 370) requires proponents of a project that is likely to have significant environmental implications to submit an Environmental Plan. Approval of this Environmental Plan by the Minister of Environment and Conservation is a prerequisite for project approval and development.

- Water Resources Act (Chapter 205) sets out the regulation, permitting and compensation requirements for any operation that has any effect on waterways. This is particularly pertinent in terms of the Porgera and Tolukuma operations.

- Dumping of Waste at Sea Act (Chapter 369) covers the regulation and permitting of the dumping of waste at sea. These are the regulations that cover issues such as submarine tailings disposal (STD) and the dumping of waste rock at sea, such as is done at Lihir.

- Environmental Contaminants Act (Chapter 368) broadly covers discharges of contaminants into the environment, and sets out procedures for licensing and compensation. Because of the overlap with the permitting process under the Water Resources Act, this Act has not been used to any great extent for the existing mines. This duplication is a common problem with the existing environmental legislation, and is addressed as part of the new Environment Act.

Recently (in 2000) the Office of Environment and Conservation (OEC) drew up (in consultation with industry and NGOs) an Environmental Code of Practice for the mining industry, covering aspects such as management of wastewater, solid waste and tailings management, atmospheric emissions, rehabilitation and monitoring.

A range of other legislation also impinges on mining operations. This includes:

- Fiscal legislation, particularly the Income Tax Act, 1959 and its amendments (discussed further below), and the Central Banking Act (Chapter 138) and the Value Added Tax Act 1998.

- Labour legislation, particularly the Employment Act (Chapter 373) and the Employment of Non-Citizens Act (Chapter 374). The latter deals with the employment of expatriates within the industry, and requirements in terms of training and localisation.

- Land legislation, particularly the Land Disputes Settlement Act (Chapter 45) and the Land Titles Commission Act, 1962. These deal with issues of ownership, dispute and title for land under, amongst other things, mining leases and customary land title. While these issues are of central importance to the industry and the legislation generally provides a workable framework for dealing with disputes and land titles, the experience of the past decade is that the bureaucratic process associated with resolution of disputes and issue of titles is often painfully slow.

There are three final points regarding the legislative regime under which the industry operates that are significant. First, the Ok Tedi operation is not subject to most of the legislation laid out above, and most controversially the Environmental Planning Act, because, like the BCL mine on Bougainville, it is governed by its own separate legislation. In the case of the Ok Tedi mine, the disastrous financial and environmental history of the mine has required eight major Supplemental Agreements to the original Act, each of which has had to be approved by Parliament.

Second, much of the current mining and environmental legislation, and some policy, is subject to review, or new legislation or policy. The new Environment Act mentioned above only needs to be gazetted to become law, there is a new draft Mining Act, and a process to draw up a Sustainability Policy for the minerals sector is underway, with World Bank assistance.

Finally, there are serious concerns among investors, affected communities and outside observers over the ability of the Papua New Guinea government to effectively and efficiently carry out its responsibilities under these various pieces of legislation. In part this is due to the fact that the various government departments with responsibilities under the Acts have been, and continue to be, severely under-resourced. There has been no increase in the budget of the Department of Mining, for example, since the early 1990s, despite a 70% drop in the real value of the allocation. This issue is returned to below.

Fiscal Regime

The basic structure of Papua New Guinea's current fiscal regime was put in place in 1974 with the renegotiation of the Bougainville Copper Agreement. The basic structure is a competitive corporate income tax, an additional profits tax (APT) to secure the bulk of resource rents, and a low rate of royalty. This was viewed throughout the late 1970s and

1980s as an effective and competitive regime, and used as a model for elsewhere. Returns to the sector under the regime were "consistent with expectations about what tax regimes would deliver", and "Papua New Guinea's share of benefits has been similar to that offered by fiscal regimes in other comparable countries" (Report of the Taxation Review, 2000:37).

From the late 1980s onwards, successive governments have added to, or amended the fiscal regime. Daniel et al (2000) note that there were 13 significant changes to the fiscal regime under which mining projects operated between 1995 and 1999. These changes have, in the main, increased the taxation load on the industry, tended to be cost-based (rather than profit focussed), and been made in an ad hoc fashion without regard to the overall effect of the regime. The apparently unpredictability of changes to the fiscal terms for mining companies and the increasing focus on additional up-front taxes, have both severely dented investor confidence, as discussed below. The Papua New Guinea government itself has recently assessed the fiscal regime as being uncompetitive by international standards.

The most significant recent changes in the 2001 Budget, aimed in part at addressing the increasing taxation load on the industry, include:

- Corporate tax for mining reduced to 30% and withholding tax for mining reduced to 10%.

- Loss carry forward for mining and petroleum industries increased from 7 to 20 years.

- Fiscal stability guarantees for 10-20 years will apply for new projects.

- The introduction of a Mining Levy (set at 4% of gross revenues) to cover the reduction in import duties paid by the industry, which from 1998 became zero-rated for tax under the VAT system. It has now been agreed that this will be phased out over four years.

- APT will be paid at the rate of 20% on any return in excess of 15% on investment and at the rate of 25% on returns in excess of 20% on investment. The initial rate of return at which APT will be paid is lower than it was previously (20%), although when combined with the corporate income tax reduction and the lower rate of APT at this level, the impact in practice is small. In terms of investor perception, however, an APT which becomes payable at 15% is not going to be attractive.

- The tax credit scheme (discussed below) has been reduced from 2% of taxable income to 0.75%.

While the first three (and particularly the third) of these provide inducements and benefits to the industry, the same can not be said for the last three, and for reasons discussed below the last of these changes could impact seriously on the ability of mining to contribute to sustainable development at local and provincial levels.

Sources

Barwick 2000, Daniel et al 2000, Hancock 2001, Iamo 2000, Rolpagarea and Szwedzicki 2001, Report of Taxation Review 2000, Tilton et al 1986.

2.6 The Small-Scale and Artisanal Mining Sector

Small-scale mining issues in Papua New Guinea (and more generally) are being addressed by MMSD as part of a broader review of small-scale mining in Asia-Pacific. The comments that follow are kept brief as a result. The significance of the sector and its geographic spread were noted earlier.

As stated above gold produced by small-scale miners makes an important contribution to the Papua New Guinea economy. Production is estimated to be worth up to K150 million annually, or some 1.4% of GDP. The sector generates cash earnings and purchasing power directly at village level with subsequent multiplier effects higher than the equivalent production from the large scale mines.

About 50 000 people (or approximately 9% of the Papua New Guinea population) are directly involved in the sector, and at least a further 8% indirectly (including non-mining family members and local suppliers of goods to miners and their families). Those directly involved represent almost 10 times the number directly employed by the large-scale mining sector, although incomes are much lower. About 35% of those directly involved are women, children and youth, again a distinct difference from the large mines where adult males make up the overwhelming majority of the workforce.

Three main types of small-scale mining operation have been identified in Papua New Guinea:

1. Artisanal hand miners, who use simple panning dishes, shovels and rudimentary sluice boxes. Mining and gold recovery are both very inefficient.

2. Simple mechanised miners, who use hand held portable equipment such as pontoon dredges, hydraulic sluice pumps, and sluice boxes. These provide improved gold output over the artisanal miners.

3. Mechanised miners, with heavy earthmoving equipment such as bulldozers and excavators and high capacity ore processing plant such as trommels and jigs.

Of these, the artisanal miners (often working in family or kinship groups) comprise by far the largest group by number. The activity is located across the country on a far wider scale than previously thought and in places not previously regarded as mining areas. Because of this, and because of the large numbers of people involved, small-scale mining is supported by the government as a rurally based industry in which participation of Papua New Guineans is encouraged.

The sector does present some problems. The activity as it is currently widely practiced is hazardous in health, safety and environmental terms, particularly with the widespread and

uncontrolled use of mercury. Regulation of the industry is currently poor due to a severe lack of resources within the Department of Mining, although the European Union has recently committed 6.5 million Euros to an institutional strengthening process within the Department of Mining, including support for the regulation of alluvial mining.

Sources

Burke, 2001.

2.7 Community Issues

Identified above as one of the key stakeholders in the mineral sector in Papua New Guinea, communities are central to many of the issues linking mining and sustainable development in Papua New Guinea. The following presents a brief précis of the major issues concerning mining and communities by first outlining some key aspects of Papua New Guinea communities as they relate to mining, then discussing the formal channels and opportunities for community participation in mining developments. This is followed by a review of the major economic, social and cultural impacts recorded for communities, and the section concludes with a brief statement on community attitudes towards mining development.

Community in Papua New Guinea

Any brief discussion of mining and community issues is sure to do damage to the variety and complexity of issues at the different mining operations. However, in the context of mining in contemporary Papua New Guinea a number of general statements can be made in relation to community issues. Four related critical issues concerning communities in Papua New Guinea are provided here as background to the discussion that follows.

The first is that any resource development in Papua New Guinea which deals with land is likely to generate a range of complex issues, many of which do not appear to be amenable to any, let alone simple, resolution. One of the most quoted statements in Papua New Guinea relating to land was made by three young Bougainvilleans who quoted their people as saying:

> *Land is our life. Land is our physical life – food and sustenance. Land is our social life: it is marriage; it is status; it is security; it is politics; in fact it is our only world. When you [the Administration] take our land, you cut away the very heart of our existence. We have little or no experience of social survival detached from the land. For us to be completely landless is a nightmare which no dollar in the pocket or dollar in the bank will allay: we are a threatened people*

(Dove et al 1974:182).

This relationship between Papua New Guineans and land has often been presented in clichéd and almost mystical terms, but it is clear that communities in most parts of Papua New Guinea retain strong cultural associations to land. However, as the quote from Dove et al makes clear, the relationship has a strongly pragmatic basis – land provided the economic and social basis for the society through subsistence agriculture. This pragmatic basis has come out time and again in negotiations between communities and resource developers in

Papua New Guinea, and accounts for why mining operations have been able to become established in Papua New Guinea at all.

This is not to say that communities are simply willing to hand over land for mining developments. Indeed negotiations over access to land, over compensation for land, and over ownership of land consume a significant proportion of the time required to develop a mine in Papua New Guinea. But it does indicate that while land is central to societies in Papua New Guinea it is possible for resource developers, with appropriate resources and patience, to negotiate access to land on terms that communities find acceptable.

Critics and outside observers not familiar with Papua New Guinea society may wonder about the role of legislation and state coercion in relation to the above statements. But government policy and legislation since the late 1980s have required resource developers to negotiate access to land with landowners (as is discussed below). These formal requirements have been made largely irrelevant though, by the broader issue of the relationship between the state and communities in Papua New Guinea. Since the 1980s, the state has faced growing internal legitimacy problems. There is a range of reasons for this (including the inability of the state to deliver basic services and any form of development to most communities since Independence, the growing disenchantment with the corrupt and self-interested behaviour of political leaders, and the increasingly "weak" nature of the state) but perhaps the most fundamental is the continuing autonomy of local communities.

As many observers have noted, Papua New Guinea is socially extremely diverse. Prior to its colonisation in the late 19th century, hundreds of small-scale communities operated as independent autonomous groups with little notion of regional, let alone national cohesion. The 700 or more languages still used today are testimony to the continuing influence of these local cultural and political entities. The strongest allegiances held by the majority of Papua New Guineans continue to be local. The continuing strength of local interests in contemporary Papua New Guinea is manifest in a range of ways, including highly localised patterns of voting in national elections, influential kin-group patronage within state mechanisms and institutions, and the pursuit of parochial political, economic and even environmental agendas.

In the mining sector this issue of local autonomy is strongly reflected in terms of the tensions between state and national interests. In this context few communities are prepared to have their interests subsumed by broader national interests. The obvious examples of this are the closure of BCL's Panguna mine in 1989 by disgruntled landowners, the intensely localised politics and legal action that crippled and then closed CRA's Mt Kare operation in 1992, and the lawsuit against BHP taken out by landowners downstream of the Ok Tedi mine between 1994-96. These three cases are simply the more obvious examples of a general point: that landowning communities in Papua New Guinea continue to have the power to subvert state and corporate agendas if they feel their own interests are under threat.

The notion of community is itself often misleading in the Papua New Guinea context. While it is certainly possible to distinguish relatively coherent groups (tribes or clans) in many parts of Papua New Guinea, the bulk of these are far from discrete, bounded, and consistent groups. In the case of development projects, particularly resource projects such as mining developments, landowning communities are likely to come under pressure to count

among their members those who have been absent from the area for lengthy periods (even generations), relatives of those who have married in to the community, students who have been away at high schools or universities, and others who may arrive offering assistance of various kinds. Communities, then, are likely to include an array of individuals with a range of rights and entitlements under traditional systems, many of which are not easily discernible to corporate or government agents attempting to determine the limits to 'the community'.

A related problem is that in many parts, and particularly throughout the Highlands (where the classic big-man model of leadership prevails), leadership roles are achieved, rather than inherited or attained through democratic processes. Because leadership in such societies is a process rather than a position (leaders have to continually or at least regularly re-establish or maintain their position)) representation of groups is a more dynamic process than can be accommodated by existing forms of legislation or agreements. Community leaders, in other words, are subject to change while agreements tend to fix certain individuals as representatives and as a result it is often difficult to determine which leaders represent community opinion and decisions, and how they do so.

A final comment that is related to all of the earlier points is that the widespread disillusionment with governments (local, provincial and national), along with the wealth that has been generated locally by the existing mines, resulted in mining becoming synonymous with development in many areas during the 1980s and 1990s. Because of the lack of other alternatives for development, many rural Papua New Guinea communities regarded mining as an acceptable and appropriate vehicle to bring improved health, education and economic opportunities. Such attitudes are still widespread, although tempered in places by disillusionment with the lack of new mining developments since the mid-1990s. This is discussed further below in terms of community attitudes towards mining.

Mechanisms for Community Consultation and Participation

As indicated above, community participation in the mine development process is circumscribed by both legislation (particularly the Mining Act 1992 and the Water Resources Act) and the limited extent of state legitimacy on the ground. This participation begins during exploration, when Exploration Lease (EL) hearings are held in the area of the proposed lease. At this stage there is often little understanding of the process or likely outcomes, and the role of the DoM mining warden is important.

Once a mine is likely to proceed to development, the community become involved in a number of negotiations and forums. Community consultation has been part of the EIA and SEIS process since the 1980s, but recently this has become much more participatory, with the work carried out as part of the Ramu EIA involving widespread community participatory and strengthening programmes. Three of the most critical sets of negotiations prior to large mines receiving approval from the National Government are the negotiation of compensation and relocation agreements, and the Development Forum. In the most recent cases (Lihir and Ramu) these three occurred as part of the one process, with the protracted negotiations over what is known as an Integrated Benefits Package (IBP). This is an example

of where practice has led policy in Papua New Guinea. Compensation and relocation agreements of various kinds had been negotiated at Bougainville and Ok Tedi, however comprehensive compensation and relocation agreements became institutionalised in the late 1980s, building particularly on the agreements negotiated at Porgera. The Development Forum concept again became incorporated into the Mining Act of 1992 after the concept had proved so useful in the negotiations in the case of Porgera in 1988-89. While the compensation and relocation agreements are critical in terms of determining a significant proportion of the material benefits that communities receive, the Development Forum is the most high-profile involvement of communities in the mine development process. In brief a Development Forum is a process of negotiation between National, Provincial and Local-level governments, affected landowners and the mining corporation that occur prior to the issuing of a SML. The concept is discussed further below. The outcomes in the past have been a tripartite set of agreements between national government, provincial government and landowners, and a Mine Development Contract (MDC) between the national government and the mining corporation.

Once a mine is operating, ongoing consultations between communities, the company and the various levels of government do occur, although there is often no legislative basis for this. The form that these consultations take varies between mine operations. In the Porgera case, it includes monthly Community Issues Committee (CIC) meetings between landowner representatives and mine management, the involvement of landowners on the PJV management board meetings, and the involvement of both company and landowner representatives on a range of other boards and committees. These are as diverse as quarterly liaison, business development and social monitoring meetings, the Porgera Development Authority board, SML Children's Trust board, School boards and employment committees.

Closure planning is obviously an area that requires substantial community input. The issue of closure planning is relatively new in the Papua New Guinea minerals sector (the DoM and OEC are still developing a policy on it, as discussed below), and it is not exactly clear what form community participation will take. It does appear on the basis of the work done to date at the various mines, that this participation will vary in its form from mine to mine.

Community Change and Transformation

Mining has wrought massive social and economic changes for local communities in Papua New Guinea. The review that follows is premised on the belief that many (although not all) of the social and cultural impacts of large-scale mines are themselves consequences of the economic changes engendered by the mine operations. For this reason the economic changes are reviewed initially, followed in order by social, political and cultural changes. It should also be noted that a distinction is often made between those direct impacts of the mine (physical dislocation and payment of monies), and the secondary effects of a mine development (the bulk of the social, political and cultural changes). The distinction becomes important in terms of the responsibility for the effects with, in the past, companies arguing that they could not be held responsible for a range of social changes that they had no control over in the communities around the mine. Such a distinction, though, holds much less weight with affected landowning communities.

Economic Impacts

A range of substantial flows of revenues to communities come into effect with the establishment of a large-scale mine. Because the mines are located in areas that were previously peripheral to the cash economy in Papua New Guinea, these flows of money transform the economic and social basis of the communities. The types of payments and the uses to which the flows of money are put are of central interest to an analysis of mining and sustainable development. The nature and amounts of the payments themselves, and particularly compensation payments, have been discussed in depth in a range of other publications. An outline of the different types and their significance is presented here, along with a brief discussion of the way in which these monies have been employed. The most detailed publicly available work is from Porgera.

Seven main types of monetary flows to communities can be identified. The geographic and temporal spread of each of these is different, and influences the responses of the different recipients through time. Cash payments of compensation for the loss or damage to bush or 'improvements' (houses, structures, crops and gardens) are the most significant flow of cash during the construction phase of a mine operation. While not a benefit of the mine, the huge sums involved during construction are generally treated as a new revenue stream by the recipients, rather than as recompense for loss. In terms of its geographic spread, compensation payments match the areas affected by mine operations, so can be spread outside of mining leases.

Compensation is a requirement of the Mining Act 1992 as noted earlier, and the specific rates paid are based on Compensation Agreements that are required prior to the issue of a mining lease. Such agreements generally use as a starting point the list of values for crops and trees published regularly by the Papua New Guinea Valuer-General's office. In each case, though, communities have argued for higher values for crops of particular local economic or cultural value. Compensation assessments are typically carried out by company officers accompanied by the affected landowner(s) and approved by a government officer prior to payment. While most Compensation Agreements require detailed counts of plants and trees prior to damage occurring, in practice assessments are often made on a per hectare basis for gardens and bush. These per hectare rates are calculated on the basis of numerous detailed counts, and are then negotiated and agreed to by local communities.

The total amounts of compensation paid obviously vary between mine operations depending on the area of leases, the areas of land disturbed, the pre-existing uses established on the land, and the precise values contained in the respective Compensation Agreement. The average amount of compensation received per person per year likewise varies substantially depending on the population of the area where the damage occurred. An additional problem in terms of analysing compensation noted by Filer et al (2000) is that company record keeping procedures vary enormously (between operations and though time, with the chaos of construction resulting in particularly poor records). This makes the compilation of comparisons between operations difficult. That said, Table 8 provides an estimate of the general compensation payments made to mine site communities for the various mine operations.

Mine	Period	Value (K million)
Panguna	1972-1989	17.0
Porgera	1989-2000	21.0
Lihir	1995-1997	12.5
Ok Tedi	1982-1996	15.7
Misima	1987-1996	3.0
Tolukuma	1994-1997	1.6

Table 8: Value of Compensation payments made by project, various years
(Sources: Based on Filer et al 2000, Porgera project documentation)

Note that this does not include the K39 million paid out by OTML to downstream communities over the period 1996-97 as compensation for the environmental impact. Issues concerning compensation will be elaborated on below in terms of sustainable development.

Occupation fees were a requirement of the earlier 1977 Mining Act and hence were incorporated into Compensation Agreements prior to 1992. These are annual per hectare rental payments for land under a mining lease that took into account the amount of disturbance to the land. The rates paid varied, and the significance of such payments likewise varied from one project to another: relatively unimportant at Porgera, but substantial at Ok Tedi where much larger leases were used.

Mining companies pay royalties of 2% of gross value of production to the State. The State, since 1974, has passed these on to the landowners and Provincial Governments that host each of the mines. Unlike compensation flows, these become more significant after construction. The amounts paid and received obviously depend on the value of production, which can vary depending on output and global commodity prices. Initially, in the case of Bouganiville, 5% of these royalties were paid to the landowners, and the rest were paid to the Provincial Government. From the Porgera negotiations onwards, landowners have claimed an increasing share of **royalties**. In the Porgera case, after initially receiving 23% of mine royalties, Porgera landowners and local institutions negotiated an increase in 1995 to 50%, and the same percentage was agreed by the Lihir landowners and LLG. The 50% at Porgera is further broken down as shown in Table 9. Further details on some of these key institutions at Porgera are provided below.

Recipient	Percentage
Porgera Development Authority	5
Special Mining Lease Landowners	15
Special Mining Lease Landowners Children's Trust	10
Special Mining Lease Young Adults	8
Porgera Landowners Association	12

Table 9: Distribution of Royalties at Porgera, 1996
(Source: Banks and Bonnell 1997:40)

Royalties for landowners and these institutions were worth a total of K7.35 million in 2000. At Ok Tedi, royalties for the 400 landowners with rights within the SML were estimated at K1.5 million in 1993: by 2000 this is likely to have been closer to K3 million. At Lihir,

royalties to local landowners and institutions were worth almost K6 million in 2000, split between the LLG (60%) and the SML landowners (40%). In terms of geographic spread of payments, royalties within the community are only paid to the recognised landowners of the SML.

Another innovation from the late 1980s is the taking up of direct equity in the mines by local landowners. Initially – at Porgera – this was carried equity. Currently policy is for landowners and Provincial Government to share 5% free equity in new mining developments. Both the Enga Provincial Government and the Porgera landowners hold 2.5% equity in the Porgera mine. Lihir landowners hold a 6.8% stake in Lihir Gold Ltd through an entity called Mineral Resources Lihir. Dividends generated by this equity stake can take some time to become significant (especially in the case of carried equity), but when they do start being paid they can be substantial, and may even dwarf the amounts paid in royalties. The structure of the companies by which landowners equity is held varies, and hence the geographic spread of dividend payments also varies: at Porgera only SML landowners receive these.

Wages paid to local employees constitute the most widely spread and consistent flows of money into the local community. They can be substantial. In the case of Porgera, in 1996 the 886 Porgeran employees earned an estimated total of K5.56 million. Wages are a local revenue stream that increases through time due to the movement of local employees into higher positions within the company under the required corporate training and localisation schemes, and wage increases.

Business contracts are often one of the most sought after economic benefits of the development of a large-scale mine. The reality, however, is that many business contracts issued to local contractors hold more prestige than economic value. This is largely because of the high costs of operating businesses in the Papua New Guinea environment, cultural constraints on good business practices and relatively inexperienced business owners. The mining companies are required to assist local business development, and give preference to local businesses wherever possible. They monitor and report quarterly on local business development issues, and regularly provide details on the value of local contracts issued. The PJV, for example, report that to the end of 2000, they had issued over 6,000 operations contracts worth K100 million to Porgeran businesses. This disguises the fact that much of this value was for joint ventures between Porgeran and outside companies (particularly for large contracts such as catering or janitorial services). In addition, clearly the flows of money into the community as a result are a small proportion of the value of the contract, particularly as local multiplier effects are small for bus hire and freight contracts, for example.

The mining companies do also regularly respond to requests for **donations** from individuals and organisations. Again the value of these donations will vary between the mine operations, and through time. The PJV over the period 1989-2000 have paid out over K.8 million in donations to mostly individuals and groups across Papua New Guinea, focussing particularly on the areas affected by their operation. These donations are often in kind rather than cash.

The above outlines the nature of revenue flows into communities from mining operations. These have increased dramatically since the closure of the Bougainville mine, the implicit assumption of the state being that more revenues for local communities will reduce the chances of them following the example of the Bougainvillean landowners. In many respects, though, the central issue is less to do with the total amounts of money received by the local communities or the level of equity of monies received (although both these factors are not unimportant) but rather the ways in which the funds are employed. The bulk of the monies paid are paid in cash, and there is ample evidence (and even more anecdotes) suggesting that much of this revenue quickly leaves the area. Research at Porgera, for example, provided an estimate that just 5-10% of compensation payments were put into investments, 20-25% went into business developments (most of which quickly failed), and the remainder (65-75%) had been consumed, or redistributed then consumed within Porgera, or distributed to people outside Porgera. There is evidence that much of the cash flowing to individuals in the community is distributed widely among community members. This has the positive effect of spreading the economic benefits of the mine among most in the community, but given that the smaller amounts of cash are more likely to be consumed quickly, it does work against the longer-term accumulation of assets within the community. This consumption includes expenditures both in the modern sector of the economy (from new vehicles and international travel, to foodstuffs and alcohol), and investments into the traditional sector (especially brideprice and death compensation payments). This latter category also includes men taking new, additional wives using cash from compensation payments rather than more traditional brideprice items (pigs etc): one sample of 100 SML households at Porgera showed an increase in the rate of polygamous marriages from 19% in 1989 to 50% in 1993. These patterns of expenditure pose a number of issues for the achievement of any form of sustainable local economy, and are discussed further below.

Social Impacts

The enormous increases in revenue flows into local communities detailed above are fundamental to a range of associated social changes that occur in these communities. Again, while many of the trends described below are similar, the actual nature of changes varies between mine operation, and through time. One of the most significant impacts from the point of view of the community and the company is the migration of people into the mine area. The existing mine operations are the single largest economic activities in each of their regions, and hence they provide a strong attraction for people from elsewhere in the province and beyond. Migrants come in two broad (and occasionally linked) categories: those with kinship or marriage ties into the area, and more opportunistic migrants. Immigrants ('outsiders' and 'squatters' are two other terms often used to describe them by all the main stakeholders) are a particular problem at Porgera, due to the ease of access from elsewhere in the highlands. While it is more difficult for people to migrate to the islands with mines, there have still been rapid population increases recorded on Lihir and Misima. On customary land outside of the mining leases, there is nothing the mining company or the state is able to do about this issue. While those with no kinship links to the society are numerous, it is kin and those relatives by marriage who pose the biggest dilemmas for communities. It is virtually impossible for an individual to refuse kin, especially when they are able to provide additional support and security of numbers. At the community level,

though, it leads to the build up of a large mass of people with weak links into the society as a whole and a disruptive influence on local social control, leadership and lifestyles. The end result is that locals complain of 'faces we do not know' as the biggest social challenge that the mine has introduced, even though individually they are implicated in the process. From the corporate and state perspective these migrants represent an increased security risk and effectively dilute the benefits that they provide to the host communities.

In terms of community **health**, a basic paradox arises. This is that although resources available locally for health services typically increase markedly with the advent of a mine development, this does not necessarily translate into improved community health due to the introduction of new diseases. A constraint on discussing the impacts of a mine on community health is the relative dearth of long-term comprehensive studies. Much of the data are patchy in terms of geographical, temporal or disease focus. From the information that is available, a number of broad trends can be identified. In places, mine-sourced health programmes have brought tremendous benefits to local populations: the reduction in malaria and filarisis, and the subsequent dramatic increase in life expectancy in the area covered by Ok Tedi's medical services is a much cited example. At Porgera, Maternal and Child Health (MCH) programmes, a yaws eradication programme in the Strickland, and an initiative with the World Health Organisation (WHO) to address health issues in the Lagaip and Strickland areas are all examples of programmes where corporate resources have assisted better health service delivery. Improvements in local water supplies have also contributed to reductions in some health problems including scabies and dysentery. On the other hand, increased rates of other health concerns such asthma, dental problems and communicable diseases, including sexually transmitted diseases (STDs), have been recorded at Porgera and other mine sites. Local perceptions of health changes over the life of a mine are often negative, even where there is evidence of improvement in some aspects. Increasing rates of STDs including HIV/AIDS are of particular concern to women in the communities.

As with health, access to education services and facilities improves dramatically for communities close to the large mines, and often communities elsewhere in the province. This occurs in a number of ways. The mining company is often involved in the provision of new classrooms and facilities either directly or, more typically, through the Tax Credit Scheme (TCS). Since 1989 at Porgera the number of community schools had increased from four to six, a high school was established, along with an International primary school, the vocational centre was substantially upgraded, and a College of Distance Education study centre was set up in 1991. The PJV has also built a significant number of classrooms in other parts of Enga Province, Southern Highlands Province and in Western Province. Other increases in educational opportunities come through scholarships. These can be in the form of corporate support, or through the use of Trust Fund (such as the Porgera SML Landowner's Childrens Trust) monies. These scholarships are generally for in-country or overseas High School or tertiary education. On the negative side, the substantial flows of revenue that mine-site communities receive can act as a disincentive for schooling for both parents and children. Despite this, community and corporate stakeholders generally see education as one of the most significant, lasting benefits that a community can derive from the presence of a large-scale mine.

Where households are required to move dwellings due to a mine operation, the legal requirement is that they must be provided with a house of at least the same size and quality

as that which they lost. In all cases the design of replacement homes has been a central part of **Relocation** Agreements, and have been homes of permanent materials rather than the typical bush materials housing they have replaced. The amount of relocation required has varied substantially, with the over 600 relocated households at Porgera being easily the largest. The most lavish relocation homes to date have been those built at Lihir, where the total value of the package in the mid-1990s was worth over K100,000. Finding an alternative site for the relocation home can be problematic, although at Porgera the cognatic social structure meant that individuals had a range of residential options available to them. In that situation, individuals were required to identify a site for the house and the company then cleared and levelled the site before constructing the house. Community concerns with relocation programmes tend to focus on two issues that take several years to surface. The first of these is the maintenance of permanent materials houses, with few community members possessing these skills and the companies reluctant to become engaged in this process. The second issue is the increasing pressure put on relocation housing by growing household sizes, and the demands of youth for an equivalent dwelling when they marry. A recent initiative at Porgera seeks to reduce the extent of both these pressures by offering an alternative relocation package whereby 90% of the value of the relocation package is put into a trust fund over the life of the mine. This concept is predicated on the understanding that those who accept this package (and over 80% of those eligible have taken it up) will build a bush materials house elsewhere, or find alternative accommodation. This package obviously overcomes maintenance concerns, and means the intergenerational transfer of this benefit becomes easier.

Like mining elsewhere, the large-scale operations in Papua New Guinea have introduced a range of social ills into the communities that host them. While accurate figures on these trends are generally absent (they have been most clearly documented at Porgera), anecdotal evidence strongly suggests that are also present to varying degrees at the other sites. They include the widespread availability and consumption of alcohol (often despite alcohol bans in the community), an increased prevalence of gambling (particularly cards and for several years Porgera supported 30 electronic poker machines) and other forms of entertainment seen as less than desirable, the introduction of or significant increase in prostitution, and a widely perceived breakdown in law and order. Violence, either alcohol induced, domestic or both, increases and migrants often attenuate traditional forms of violence such as tribal fighting. These trends are particularly worrying for traditional community members who blame recent migrants for them. Whatever the cause, traditional community members have far less control over these trends than they did in the past.

Finally, a major social trend present at all the mine sites is the shift from a predominately subsistence lifestyle to a cash-based one. While the mines have this in common with many other forms of development, the fact that the mines will only provide a short-term basis for this shift does add a further dimension, particularly when a generation of children are not being skilled in subsistence methods.

Political Impacts

In terms of political change, two general impacts at the community level can be discerned. First, internal community leadership and representation can become deeply problematic

over the life of the mine. Representatives are formally appointed through the use of an agency system whereby individual members of the community give (usually) written assent to nominated agents. These agents, generally people of standing and influence in the community, are then recognised as the individuals with whom company and state must deal with. They are also central to the systems for royalty and compensation distributions. While these individuals will generally have widespread community support at the start of the mine operation, the rapid, profound, complex and unevenly distributed changes that accompany the mine development often bring about changes in the power of different individuals. The nature of the agency system, though, makes it hard for the formal representative structures to reflect these changes. Most significantly, younger, better-educated people find it difficult to become formally recognised as a community representative in dealings with the company and the state due to the nature of the agency system. This can force them to find other avenues to pursue for influence in the relationships with the state and corporation.

Second, the political sway of the local community, and particularly the leaders of the community, becomes much more significant within the broader Papua New Guinea context. The community representatives become politically connected at the national level and often have access to the highest political circles in the country. Similarly the community as a whole has a much greater recognition and an increased political influence within the country.

Cultural Effects

Given the diversity of pre-mine societies and cultures, the cultural impact of the various mines is obviously varied. Within this variety, several key trends can be discerned. Firstly the issue of identity – at both individual and group levels – becomes more contested. As the recognised landowning group (be they Porgerans, Misimans or Lihirans) starts to become the recipient of economic benefits, more and more individuals seek to identify with this group. This leads to debates over the 'rules' of membership of the key group, with 'outsiders' often arguing for a liberal interpretation of membership. Generally, though, the community tightens the requirements for group belonging as the mine develops: the social structure becomes less fluid. Individuals within the community often begin to develop a sense of identity as members of the affected community (Porgeran or Lihiran, for example) whereas before their identity was more closely linked to kinship or tribal groups.

A second, related issue is that of the geographic boundaries between groups. In most parts of Papua New Guinea, boundaries between groups are usually not precisely known, and are often fluid. The rights of individuals and groups to carry out different activities (ceremonies, hunting, residence, gardening etc) were often spread over different areas, and the spatial extent of some of these rights overlapped with other groups. As boundaries become critical to accessing benefits from a mine development, they become precise and fixed. This can lead to the privileging of some rights at the exclusion of others. To take a practical example, one group with traditional rights to hunt in an area may not have this recognised in the distribution of benefits from a mine if there are groups with a more complete set of rights (such as residence) to the area.

Linked to this, at the broader level a mine development can redefine regional relationships between groups. Typically a relatively isolated and remote group, at the fringes of provincial and national economies and politics, is transformed into a group of provincial and national significance. Prior to the development of the mine at Porgera, for example, the Ipili people in the valley were regarded as less developed by the dominant Enga populations in the province. The advent of the mine has obviously reversed this situation, a point of annoyance to some Engans. Underlining the way in which outside groups seek to establish claims to benefits from resource developments, Huli people from the Southern Highlands now relate myths that link them ancestrally with resource site communities to the north (Porgera), south (Kutubu oilfields) and even as far west as Ok Tedi. Hence Huli now describe the origins of the Ok Tedi, Porgera and Frieda deposits as sites at which mythical ancestors rested. In this fashion, a wide range of groups often assert rights to a share of the benefit streams that mines generate, and can impose claims on the community around the mine itself.

Some local cultural traditions and practices generally decline, or their significance is altered. In many cases such practices were in decline in any case. At some locations the companies deliberately intervene to try and support cultural institutions or events. Older locals in particular regularly lament the loss of tradition, as part of a broader concern with the way in which communities now derive their focus and motivation by looking forward at the expense of interest in history and tradition. Of course such concerns are not limited to communities impacted by mining – indeed it appears to be a symptom of modernisation generally.

While much of the above is often glossed as cultural destruction or the like, this is an external view of the process. Anthropologists have shown that local understandings of this process can differ markedly. Local cosmologies and myths, for example, are often reinterpreted in the light of the arrival of the mine. In this way the mines can be appropriated by and incorporated into local understandings of the world. One example of this is the way in which

Community Attitudes Towards Mining

At all the Papua New Guinea mine sites, community understandings of the mine operation are a blend of local perceptions based around traditional understandings of how the world works and more contemporary concepts, such as business practices and western forms of governance. This understanding varies markedly within each of the communities, with factors such as age, gender, education level and pre-mine power relationships all influencing the ways in which particular individuals respond to the arrival of a large-scale mine. Once a mine starts operations, the range of economic and social factors outlined above begin to play out in an uneven way between and across communities. So, for example, some individuals and communities receive royalties, and some do not; some individuals are employed by the mine and others are not, and so on. For this reason it is exceedingly difficult to talk of 'community' attitudes towards mining. Even in the extreme case of Bougainville it is clear that some members of the community regarded the mine with an ambivalence certainly not shared by those who brought about its closure.

As a general rule, though, the following appears to apply. Since Bougainville, where landowners resisted the intrusion of company geologists and other staff onto their land, communities have tended to look favourably on the activities of exploration geologists and, while negotiating vigorously, have rarely come out against proposed mines. This is largely because of the lack of other viable paths to development: as discussed above, governments are not seen as an effective provider of desired goods and services to communities. Once mines are constructed and operating however, the different impacts described above and other unanticipated (from the perspective of the community at least) changes begin to weaken broad community support for the mine operation. At various times different sections or individuals from the community will voice concerns about a range of social, environmental and/ or economic changes (or lack of change in the case of the latter) for which they hold the mine responsible. Many of these are legitimate and strongly held views: some, though, are aimed at internal community agendas, or are seeking external assistance in obtaining further or different forms of support for the community. Almost without fail, even those mine- affected communities that have representatives expressing strong disapproval of the mine's actions are not seeking the closure of the mine. Instead, concerns about the nature, the magnitude and the distribution of economic benefits are typically behind community statements denouncing aspects of mining operations. Even in the case of the most affected communities downstream of Ok Tedi, appeals to remedy existing environmental impacts are commonly mixed with calls for various forms of development assistance.

Cutting across these general observations, we can also note that many older people view the prospects and reality of mining with trepidation and concern, although some of them will regard as important the benefits in prestige associated with being responsible for bringing in 'development'. Many of them subsequently see a breakdown in the traditional values of the society and regard this as not worth the benefits that mining brings. On the other hand, the younger, better-educated males in particular see new developments such as mines as a chance to subvert existing structures and power structures within the society. For them, a mine offers new avenues to achieving status in the community. Women tend to have a different set of attitudes to males in the community. Their concerns tend to be related to both their exclusion from a share of the economic benefits of the mine, and more broadly at the impacts of the mine on family-life and subsistence production.

A final element of attitudes towards mining is that communities and individuals almost invariably seek to build a relationship with the mining company. In this sense, as noted above, companies are treated in similar terms to the state and others both inside and outside the community. That is, people seek to build and maintain social and economic relationships with 'the company'. Most commonly the approach is to target personal relationships with particular groups (especially expatriates) or figures (senior management) within the company that are regarded as significant. Such relationship building is not just an exercise to access economic benefits from the mine, it is also concerned with bringing the mine operation into local social and political networks. Perceived barriers to interaction (ranging from the FIFO of non-local mine employees to fences around mine townships) are likely to adversely affect the attitudes of community members towards the mine operation as they reduce the opportunities for the nurturing of these relationships.

Sources

Banks 1997, 1998, Bonnell 1997, Burton 1991a, 1991b, 1995, Byford 2001, Filer 1991, 1997, 1999, Filer et al 2000, Flew and Paika 1996, Gardner in press, Golub 2001, Hirsch 2001, Jackson 1983, 1989, 1991, 1993, Jackson and Banks in press, Jorgenson 1997, Kirsch 1989, 1997, in press, Nurse 1990, Polier 1994, 1996, Toft 1997.

2.8 Environmental Effects of Mining

General Comments

Mining, anywhere, creates environmental impacts. As noted earlier, the early mining periods in Papua New Guinea operated without environmental regulation and created intense environmental transformation, much of which is still visible today. With the massive increase in the scale of mining, the scale and extent of the impacts on the physical environment have also increased hugely. Today, the legislation described above provides a framework for assessing and regulating (though certainly not eliminating) these environmental impacts.

The environmental impacts of the large mines in Papua New Guinea are easily the most controversial aspect of the sector, at least at the international level. It is in terms of these impacts that there is the greatest divergence of perspectives and values amongst stakeholders. There is a clear separation between the scientific monitoring and reporting of impacts (along with predictions of potential impacts) and local perceptions of impacts of mines on the environment. Partly as a consequence, the environmental impacts are the hardest to assess in terms of sustainability.

The brief review that follows outlines the nature of the environmental impacts of the existing mines, then reviews the available material for the three largest mines. As Ok Tedi has generated the largest amount of debate, and material, it is the largest of these case studies. Brief notes on rehabilitation and environmental communication conclude the section.

Environmental Issues

The environmental effects of large-scale mining in Papua New Guinea can be broken down into four main categories:

- The direct effects on land of the mine operation itself. This includes the area excavated, the processing plant and other infrastructure required by the mine. This can be both very intensive and spread over a relatively wide area. Areas need to be cleared and levelled for mine camps, towns, mill and other associated buildings, and obviously for the open pit itself. In the case of the Porgera mine these impacts have been very marked and have involved the conversion of several thousand hectares of a mix of primary and secondary forest and subsistence gardens. The impacts are very visible within the valley and are of such a nature that even with an active rehabilitation programme, many of them will take decades to return to something resembling their original state.

- Impacts on air and water in immediate surroundings. The large mine operations in Papua New Guinea can impact on the immediate environment in a number of ways. These can include: noise pollution, air pollution, dust, and diversion or pollution of water systems. At some sites these impacts are worse than others, and they can vary through time, depending on local conditions and management of the issues. These impacts are often intense, although the area affected is generally limited.

- Disposal of waste rock or overburden. Each of the mines generates large amounts of waste material, often in volumes that substantially exceed the tonnage of ore processed. Some of this material is low-grade ore that is not economic to process, and some is simply material that is required to be moved to access the ore. At Porgera, for example, around 120,000t of material is mined each day, and only 17,000t processed.

- The disposal of this waste utilises one or more of the following techniques, depending on the nature of the material and the environment the mine is operating in. Competent waste rock can be placed in stable waste dumps. This method of storage ensures that little of this waste enters river systems, although it can take up significant areas of land and can, depending on the mix of receiving environment and materials placed in the dump, raise the issue of Acid Rock Drainage (ARD). This then requires long-term management. A second form of waste disposal employed in Papua New Guinea, particularly for incompetent material, are erodible dumps, with the material being placed in the headwaters of river systems. The material then becomes entrained in natural sediment transport processes. The advantage of this form of disposal is that there are no long-term management issues such as with ARD, although local environments and systems may take many years to recover. The largest concern raised by this form of disposal is elevated sediment levels in river systems downstream and the potential impact this can have on downstream ecosystems. A third option employed at the Lihir mine for incompetent waste is that of marine disposal. The advantage of this is that it doesn't take up any land, although the potential localised impacts on ecosystems can be large.

- Tailings disposal. This is the most controversial aspect of the operations of the mines in Papua New Guinea, and the issues surrounding it are discussed further below. Tailings, finely ground residual material from the processing of the ore, often contain elevated levels of a combination of heavy metals from the original ore body and/or chemicals required as part of the mill process. As the metal extracted from the ore is generally only a small fraction (g/t in the case of gold, and up to 2% in the case of copper), the tailings generated by a operation generally correspond closely to the weight and volume of ore processed. Because of the nature of the material current (although not past) practice in most parts of the world is to contain tailings in an impoundment of some kind – generally a pond or a dam. In Papua New Guinea, in the case of all the existing mines and the BCL mine, tailings are discharged directly into the environment (rivers or the ocean). The reasons for this, as given by the industry and the government, are that high rainfall, unstable landforms, high seismic risk and, in the case of Misima and Lihir, a shortage of land, makes the retention of tailings dangerous and unmanageable. Critics

point to issues of cost rather than risk as the main reason for direct discharge of tailings into the environment in Papua New Guinea.

The impacts on river systems from the direct discharge of tailings can include significantly increased sediment levels in receiving rivers, aggradation of riverbeds and consequential over bank topping of material during floods, reduction or loss of biota and fish biomass, potential mobilisation of heavy metals into the food chain, and potential ARD from the build-up of tailings in specific environments. Disposal of tailings via Submarine Tailings Disposal (STD) into the ocean involves the discharge of tailings via a pipeline to a depth in the ocean that is below the mixing depth of surface waters. The nature and extent of the impact from any individual mine will depend on the volume of the tailings, the extent to which tailings are neutralised prior to discharge, and the nature of the receiving environment. These issues are discussed in relation to the existing mines below.

The following Table provides a summary of the tailings and waste disposal systems put in place for the various mines.

Mine	Tailings daily average (t)	Method of disposal	Waste rock daily average (t)	Method of disposal	Systems affected
Porgera	17,000	Riverine	100,000	Stable, Erodible	Local dump areas, Lagaip, Strickland, Fly rivers
Ok Tedi	80,000	Riverine	160,000	Erodible	Local dump areas, Ok Tedi, Fly rivers
Lihir	9,000	STD	30,000	Stable, Marine	Dump areas, ocean 1.5-2km offshore
Misima	16,000	STD, backfill	18,000	Stable, ocean, backfill	Pit areas, ocean
Tolokuma	400	Riverine, backfill	1,500	Stable	Mine area, Auga River

Table 10: Tailing and Waste Rock Summary
(Source: updated from Cook, 1996: 233-234)

From this brief summary it should be clear that while the environmental changes as a result of the large-scale mines are generally greatest locally, it is the downstream effects that have generated the greatest level of debate. In part this can be related to the fact that the compensation to local communities around mine sites has been far greater than for other affected communities, such as those downstream from the mines.

Ok Tedi

The Ok Tedi mine is the most controversial in terms of environmental impact. The history of this is well documented. The original mine plans included a tailings dam, but the site was destroyed by a landslide in 1984 as construction started. In the absence of any immediate alternatives, and faced with the prospect of the mine not proceeding, the government agreed to an Interim Tailings Disposal Scheme (ITDS) that comprised riverine disposal of tailings and extensive monitoring to assess the likely long-term impact. In 1989 on the basis of the monitoring results, and despite advice from several sources concerning the likely implications, this ITDS effectively became the permanent system. The impacts of the tailings in the lower Ok Tedi became obvious in the late 1980s, and local and international actors mobilised in a campaign to provide compensation to those affected, and to reduce future tailings disposal in the river. This culminated in the 1994-1996 court action against BHP (the mine's majority shareholder and manager) in the Australian courts by affected communities. This was settled in 1996, with BHP committing to implement a practicable tailings disposal system as well as paying long-term compensation, and the landowners' substantial legal fees. A dredging project in the lower Ok Tedi region initiated in 1998 to contain the impact of the tailings has removed around 20Mt of material annually, half of it tailings. The project has reportedly been successful in reducing the impacts in the area immediately downstream, although the impact of pre-existing sediment continues to increase downstream, particularly in the middle Fly region.

Between 1985 and 1998, an average of 65Mt per year of material (comprising 21Mt of tailings, and 44Mt of waste rock, overburden and mine induced erosion) was discharged by the mine operation to the Ok Tedi River. About 40Mt of this material reaches the Fly River annually. To put this in perspective, the Fly River downstream of the Strickland confluence naturally carries an annual sediment load of 100Mt per, of which 70Mt is sourced from the Strickland. In total the sediment load of the Ok Tedi River has been increased by a factor of 6-8, the middle Fly River by 100% and the lower Fly River below the Strickland junction by around 50%.

Four major impacts of this increased sediment load on the Ok Tedi and Fly River systems can be discerned. First, both tailings and waste rock derived material is transported by river systems and, as a consequence, sediment levels in the river have increased substantially. The Acceptable Particulate Level (APL) set by the Government for OTML for compliance purposes is a Total Suspended Sediment (TSS) level of 940 mg/litre at Nukumba (below the Ok Tedi-Fly confluence). Suspended sediment at Nukumba averages 480 mg/litre, compared with 130 mg/litre before mining and 700 mg/litre in the Strickland River, the major Fly tributary unconnected to the mine. Fish numbers have dropped significantly in the Ok Tedi and the Fly between the Ok Tedi junction and the Strickland River junction largely, it is assumed, because of the increased sedimentation. Fish biomass in the Ok Tedi River has been reduced by 90% over pre-mine levels, and in the middle Fly the reduction is around 50%. Fish numbers and variety to date appear to be undiminished in the Fly River flood plain and side streams.

Second, the deposition of this sediment is a major impact. While up to a third of the sediment input into the system, including waste rock and tailings, is carried through the system, there has been significant aggradation throughout the system. The bulk of this has occurred below the break in slope between the more mountainous upper Ok Tedi River, and the flat terrain from the lower Ok Tedi downstream. This has resulted in a build-up of mine sediment in the lower Ok Tedi that has caused a rise in the river bed, flooding and sediment deposition on the flood plain. This in turn has led to a smothering of vegetation and raised water tables resulting in "die-back" over an area of 500sq km, with a further 200sq km of vegetation in the upper Middle Fly under stress. Current predictions are that this could increase to more than 1,350sq km over the next 20 years. It is the extent and nature of this dieback that has had the most profound impact to date on the ecology and human populations of the lower Ok Tedi area, and can be directly linked to the legal remedies sought by the affected communities. The obvious effects include destruction of riverbank gardens, loss of sago stands, significant forest resources, and biodiversity, and reduced navigability of rivers. Less obvious are the lifestyle and cultural impacts of the destruction of such a large area of forest, gardens and riverbank villages.

Third, there have been increasing dissolved copper concentrations recorded in the lower Ok Tedi and Middle Fly since the early 1990s. Dissolved copper levels are of concern because copper can have a severe impact on flora (especially algae) and fauna at relatively low levels and in this form is biologically available. While the annual average copper concentrations in the Fly are well within PNG, Australian and WHO drinking water standards, and are anticipated to remain well below levels of biological concern, monitoring has revealed elevated short-term spikes or pulses in the recorded levels. The origin and impact of these spikes is less well understood. In the short-term, levels are such that settled water is safe to drink and fish are safe to eat. The longer-term impacts of heavy metals in the ecosystem are less clear, and the potential exists for ARD from waste rock and tailings that accumulates downstream.

Fourth, some concerns have been raised over the longer-term effects on the Fly delta of the deposition of elevated sediment levels. It is unclear what the extent and nature of this impact is likely to be, although concerns have been expressed over the impacts on commercial and subsistence fishery stocks, and over localised ARD problems from deposition of tailings and waste rock material. Studies have concluded that there is no evidence of any impacts of the mine sediment more regionally (such as the Great Barrier Reef), and that such effects are unlikely to occur. It has been pointed out that the increased sediment loads delivered to the Fly delta are probably within longer-term natural variations.

Porgera

The Porgera mine has also attracted international attention for its environmental effects, although not to the same degree as Ok Tedi. The lack of a suitable tailings retention site and economic considerations both played a part in the corporate decision to proceed with tailings disposal into the river system. The decision by the government to allow the mine to proceed with riverine disposal of tailings was controversial at the time (1989) with some government ministers opposing the plan. In 1995 an Australian NGO released a report detailing allegations of mine-induced chemical poisoning in the middle Strickland area and some

(albeit limited) detailed analysis of the build-up of heavy metals in the river system and their impacts downstream. The company commissioned an audit of their downstream environmental impact from the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO). This report (CSIRO, 1996) found that there was no evidence of any impacts on human health, and no significant environmental impacts downstream, although the company's environmental monitoring programme and data were found to be lacking in several respects.

Around 6Mt of tailings and 10-15Mt of waste rock is contributed annually by the Porgera mine to the sediment load of the Porgera River. This then flows into the Lagaip River, and eventually into the Strickland River that joins the Fly River close to the Fly delta. The key differences between Ok Tedi and Porgera are both the total amounts of material discharged into the river systems (16-21Mt per annum at Porgera against 65Mt at Ok Tedi) and the nature of the receiving environments. Unlike the Ok Tedi situation, the natural sediment loads in the Lagaip and Strickland Rivers are in excess of the mine's contribution. Recent data indicates that mine-sourced sediments comprise up to 24% of the total suspended sediment load and between 25-33% of the total sediment load in the middle Strickland region. Given the fluctuations in flows within the river system, it has been noted that the contribution of PJV material does vary substantially and can at times of low flows be much higher.

Three main impacts on the downstream environment river system can be discerned in the Porgera case. First, the increased sediment loads have had some impacts within the river system. There has been a marked impact on bed aggradation within the Porgera valley, but a much-reduced impact in the rest of the system due to the higher flows and natural sediment loads. Increased sediment levels do not appear to have affected the abundance of fish in the river system over the life of the mine, although the fish biomass was naturally relatively low in the fast-flowing, turbid river conditions. In the Strickland floodplain there is little evidence of overbank topping or increased flooding, although reports do exist of aggradation restricting the movement of canoes on the lower Strickland River. One unusual feature of the river system is the reversal of river flows that occur between the lower reaches of the Strickland River and Lake Murray. At times of high flow (15% of the time) the Strickland River runs into Lake Murray, carrying a proportion of mine-sourced sediment with it.

A second impact relates to the levels of various heavy metals in the discharges. The elevated levels occur because the metals are present in the original ore body at elevated levels. There is some debate over whether the significant metal load is a dissolved or total metal load. The company (and state) position is that dissolved metal levels are the significant measure as this is the metal in the system that is immediately bio-available: that is, it can become incorporated into the food chain. The bulk of the metals in Porgera's tailings are not in a dissolved state due to the neutralisation circuit that the mine operates. Instead they are bound with other material in, what it is argued, a stable form. Critics argue that while this form may be stable in the alkaline riverine environments that dominate the upper portions of the river system, there is the potential for mobilisation of metals in some of the more acidic lowland conditions, such as backwaters. There is evidence that concentrations of some metals in the tissues of freshwater prawns has increased over the life of the mine, and some of these concentrations (for lead and cadmium in particular) now exceed maximum residual levels established in Australia for foods.

A third issue of concern in relation to the environmental impact of the Porgera mine relates to mercury. Studies carried out prior to mining showed that mercury levels in fish tissues and human hair samples were high at Lake Murray. Given that the tailings stream contains mercury (derived from the host rock), the potential exists for these levels to be attenuated, however monitoring to date shows no further increases in metal levels in fish.

Lihir and Misima

These two operating mines are grouped together because they utilise very similar waste disposal methods. In both cases tailings are disposed of via submarine tailings discharge (STD) at a depth of more than 100m, and soft waste rock has been, or is in the case of Lihir, disposed of in the near shore environment. The most comprehensive, publicly available material on the mechanics and impacts of this method of disposal comprises a series of reviews carried out by Natural Systems Research, Environmental Consultants on behalf of Misima Mines (NSR 1996, 1997, 1999).

Misima has been disposing of approximately 5Mt of tailings annually via a STD since 1989. The intensive monitoring and survey work carried out over a 10 year period at Misima has found that the STD has operated as planned, with no surface detection of tailings over this period, and the vast bulk of the tailings settling in a confined basin at a depth of below 1,000m. The assumption is that accumulation at this depth means there will be no long-term impact on nearshore or deep water fisheries. The work has also underlined the fact that the mine tailings have not had any discernable impact on human health on Misima. In many ways Misima provides the ideal environment for successful use of STD. The slope of the seabed is relatively steep to depth, there is no recorded oceanic upswelling in the area, and the seabed bathometry is such that tailings are contained in a semi-enclosed oceanic basin.

The nearshore disposal of soft waste rock (along with increased runoff from catchments disturbed by the mine) has had a greater impact on the local environment, within a relatively limited area. Severe effects on the coastal ecology, and particularly the fringing coral reef, have occurred in a 1km stretch adjacent to the soft rock dump, with total loss of the coral reef and fisheries in this area due to the increased sedimentation. Further moderate and minor impacts extended another 4km either side of the dump. This is in line with the assessments contained in the Environmental Plan. Since the cessation of soft rock dumping in 1994, the reef environments have begun to recover, and some return of coral has even been recorded in the most severe impact area.

Tolukuma

Despite the small size and volumes of waste generated at Tolukuma, the mine has not escaped attention over its environmental impact. The disposal of up to a half of its tailings (or 200tpd) into the Auga River has generated some concern and complaints from downstream communities living along the Angabanga River. Like both Porgera and Ok Tedi discussed above, the impact is largely due to elevated sedimentation rates, although the scale is significantly less. Most recently the mine was subject to national and international attention after a one tonne container of sodium cyanide was dropped from a helicopter en

route to the mine site. An estimated 150kg of material was not recovered during a clean-up operation, but it appears none entered the river system. Although the spill had little impact on the physical environment, it did undermine the confidence of downstream communities and other stakeholders in the safety of the operation, and in the clean-up/ spill contingency procedures.

Ramu

The proposed Ramu nickel mine in Madang province has developed a plan for STD disposal of its 5Mt per annum of tailings. These tailings would be deposited at 120m depth offshore from the processing facility at Basamuk. This plan has drawn the ire of some environmental groups who claim that the receiving environment is not suitable for STD due to seasonal upswelling currents and relatively shallow slope angles. It is argued that these conditions mean that tailings could potentially be carried back up to mix with surface waters, and hence have a severe impact on coral reefs and fish stocks in the area. In defence of the plan, Highlands Pacific argue that the surrounding area already has 80Mt of sediment delivered to surface waters annually from nearby river catchments and hence the impact of their tailings will not be significant.

Rehabilitation

The development of a rehabilitation plan for areas affected by a mine is a requirement of the current legislation. In most cases this means levelling and revegetating mined out areas, ensuring that affected areas are left in a safe state, and that there are no on-going detrimental environmental effects. Where possible and desired by the community some form of productive use for the land is generally aimed at. In most cases the rehabilitation plans proposed are staged or progressive: as areas are no longer required they are rehabilitated. In addition, a recent emphasis on mine closure by corporations and government (the Department of Mining is developing a Mine Closure policy and Misima a Mine Closure Plan) ensures that physical rehabilitation of mine area landscapes is taken seriously.

Communicating Environmental Information

One issue that has consistently affected the environmental credentials of the mining industry in Papua New Guinea is the communication of environmental information to affected communities. The transmission of technical information across cultures (from the Western scientific rationale to very different understandings of how the world works) is inherently difficult. The issue is more than just one of cross-cultural communication, as there is the added complication that the state and the mines (and at times the NGOs) are often dealing with very remote communities with low levels of literacy. This combination of factors means that the information passed to communities is rarely received in the manner in which it is intended. Although there are some attempts to address this issue, it is not a simple process, and requires more effort.

At a more general level, there has been a marked improvement in the transparency of the environmental data generated by at least some of the mines in the last five years. Reports are now made available via the internet (the Ok Tedi site [http://www.oktedimining.com] in

recent times is a good example of this), or circulated to interested outside parties. A forum discussed below, the Porgera Environmental Advisory Komiti (PEAK), does offer a new model for communicating environmental information as well as involving other stakeholders in the assessment and review of environmental data. As will be seen below, though, this model also has its critics.

Sources

Cook 1996, CSIRO 1996, Hughes and Sullivan 1992, MPI 1995, 1999, 2000, NSR 1996, 1997, 1999, PJV 2000

2.9 Corporate Investment Considerations

Papua New Guinea is currently regarded as an exceptionally poor investment target by mining houses. Daniel et al (2000:64) cite a survey in which Papua New Guinea is ranked 20th out of 24 countries as a mining investment choice, despite its acknowledged high prospectivity. This is currently highlighted by the continuing failure of Highlands Pacific to attract a large nickel partner into its Ramu project, despite the project appearing to offer an attractive return on investment. The result is that exploration expenditures are at their lowest levels since the late 1970s, and the medium-term prospects for the mining industry itself are uncertain.

To some extent the loss of interest in Papua New Guinea exploration is due to global factors, with depressed commodity prices and weak global markets. There has been a drop in exploration expenditures at a global level. Papua New Guinea's experience, though, is not in proportion to these global trends – the main reasons for the decline in investor confidence are local factors. The current investment climate in Papua New Guinea is still suffering from a series of events in the late 1980s and 1990s that remain a major impediment to attracting further investment in the sector. Current corporate management identified four key events that have shaped investor perceptions of Papua New Guinea and that continue to discourage mineral investment. These are:

1. The closure of the BCL copper mine on Bougainville in 1989. The closure of this world class operation by the actions of local landowners alerted investors to both the inability of the state to guarantee on-going access to mineral deposits for investors, as well as the need to deal extensively with landowning communities, something that was not regarded as a critical business requirement up until then.

2. The political and legal events surrounding the exit of CRA from Mt Kare in 1992 did more than simply further undermine investor confidence in the state's capacity to guarantee on-going corporate access to mineral deposits identified (the Mt Kare 'rush' of 1988-89 removed up to K150 million of gold from leases controlled by CRA). In the eyes of the corporate investor there was a deliberate (and ultimately successful) political campaign at the highest level to wrestle control over a mineral deposit away from the corporation that was responsible for its discovery.

3. Equally disturbing to the investment community was the forced renegotiation by the state of an additional 15% equity in the Porgera mine in 1992. This led to a questioning of the worth of contractual arrangements made between investors and the state, and again involved a high degree of deliberate and targeted interference in the policy arena by key political figures.

4. The poor economic management during the term of the Skate government (1997-99) not only saw further policy and fiscal changes in the minerals sector discussed above, but also a degree of political corruption and abuse that had not been evident in Papua New Guinea until then.

The last three of these are examples of political risk in the true sense of the word. In 1999 the Institute of National Affairs (INA) carried out a survey from which it identified the main factors inhibiting investment generally in Papua New Guinea. They were crime and theft (often referred to as problems of law and order), corruption, lack of infrastructure and policy instability. All of these continue to be very real problems for attracting investment into the minerals sector. In terms of corruption, the National Provident Fund inquiry uncovered for the first time hard evidence of corrupt payments within the government. At least one governor has been charged with corruption related offences. Enquiries are continuing into the disappearance of approximately K150 million from the Motor Vehicles Insurance Trust and the Finance Pacific Group was prevented from making K9 million in payouts to 7 staff. In terms of infrastructure, the appalling state of the road network (and particularly the Highlands highway that links a number of key resource projects including the Porgera mine to Lae), the unreliable telephone services and, in many places, the intermittent nature of water and electricity are all cited as areas of concern for investors.

Sources

Daniel et al 2000, Manning 2000, Standish 2001

2.10 Governance

Much of the above discussion has been concerned with the governance of the minerals sector and the revenue generated. Issues such as mineral policy and legislation, the fiscal regime, the management of MRSF revenues, and the evidence of corruption in government are all factors that undermine the effective governance of the minerals sector. In this section a number of key areas are discussed, focussing on the two levels at which governance is most critical in terms of the industry: national and local.

At the national level, initiatives such as the Development Forum concept have sought to provide a more inclusive regime for the governance of the industry, with landowners and provincial government representatives becoming part of negotiating process. On the other hand, frequent alterations to policy and the fiscal regime for the industry, along with the increasing evidence of poor management and corruption within the broader government structures, have undermined the more traditional approaches to governance of the industry. One other factor that underlines the failure of government to adequately provide for more effective regulation of the industry is the lack of increase in budgets for the two government offices most centrally concerned with the industry: the Department of Mining and the

Office of Environment and Conservation (OEC). In the case of the Department of Mining, there has been no significant increase in funding in kina terms since 1992. Given inflation and the rapid devaluation of the kina over this period, the real value of the budget is around 25% of what it had been. To put this in context, the Department's budget is less than 0.5% of the value of exports from the industry. As a consequence, staffing is half what it was in 1992. In the case of Environment and Conservation, the weight given to the portfolio is illustrated by the fact that the Department was downgraded to an Office in 1995. Fortunately in terms of the ability of the offices to still function, both have been supported and strengthened by aid projects and resources: the OEC by an AusAID institutional strengthening project, and the Department of Mining by both a current European Union project, and a World Bank Technical Assistance project that is now underway. Despite these constraints, the DoM, in particular, is still well regarded by the industry and other stakeholders, largely due to the work of its project co-ordinators.

At the local level governance is also problematic. This has a number of dimensions. One central issue has been the inability or the slowness of central (and provincial) government to release funds for, and provide agreed staffing and infrastructure to local communities. This puts a great deal of pressure on local-level government and institutions. In the case of Porgera, for example, the release of provincial funds for projects and staffing was regularly late. Infrastructure such as a hospital that the National Government agreed to provide under the 1989 Porgera agreements arrived several yeas after the agreed date, and was delayed in opening by several more years due a lack of staff housing. Similar experiences have occurred at all the mine sites, and exacerbate the already weak nature of local-level government. Despite the presence of new and often effective institutions at the local level (the Porgera Development Authority is a useful case in point), the government's lack of capacity to uphold their own commitments in turn stresses the relationship between companies and local communities. One result is that mining companies are pressured to become much more involved in local-level governance, supporting or imposing their own community administrations and infrastructure development programmes. The Tax Credit Scheme (TCS) whereby companies are able to currently spend up to 0.75% of gross revenues on infrastructure projects designated and agreed by the national and provincial governments and then claim this expenditure as a tax credit, is one example of this process.

Sources

Standish 2001

Part Three: Challenges For Sustainability

3.1 Introduction

While the above provides a basic description of the minerals sector in Papua New Guinea, its contribution and its outlook, it lacks a sense of the complexity and dynamics of the current industry. Clearly the sector has a leading role in the formal economy of Papua New Guinea and has done so for some time. Equally clearly there are few existing mechanisms to ensure that revenues secured by Papua New Guinea from the sector are employed in any way to further the interests of sustainable development at national, provincial or local levels. At the same time, the environmental impacts of the various mines have been controversial, at least in the minds of some of the stakeholders. The industry then poses a complex case in terms of assessing its current and potential contribution to sustainable development.

In this section a number of key issues in terms of this contribution to sustainable development will be discussed, with a view to providing a better understanding of the Papua New Guinea industry, and illuminating aspects of the industry that may be useful in terms of broader MMSD objectives. It is recognised that the issue of sustainability and the minerals sector is contentious. It is clear, though, that the industry will be around in some shape and form for many decades, and hence this review is aimed at ensuring that Papua New Guinea as a country, and communities and governments at more local-levels are able to maximise their long-term benefits from the presence of a minerals sector.

3.2 Concern, Contention and Conflict

Like Papua New Guinea itself, the minerals sector in Papua New Guinea has an international reputation and profile for conflict and instability. Indeed conflicts around the Bougainville, Ok Tedi and Mt Kare mines have been instrumental in the development of an image of Papua New Guinea as being politically unstable (and hence a high investment risk). In Australia and elsewhere, the closure of BCL's mine on Bougainville and Ok Tedi's downstream environmental impacts are used to define the industry. While not without substance, such a reputation obscures the much broader on-going collaboration that exists between industry, government and communities within the mining sector. Within Papua New Guinea, various forms of contest and conflict are present, both at the national level in terms of the continual targeting of the sector for additional revenues and the management of mineral revenues, and at the local-level in terms of dealings with local affected communities and environmental impacts. Critics will note the first of the issues discussed below is concerned with the sustainability of the industry itself in Papua New Guinea. Rather than this being an industry-driven agenda, my rationale is simply that if this set of concerns is not addressed, then all the others become redundant.

A Future for the Industry?

Papua New Guinea is still regarded as highly prospective in terms of mineralisation. The geological setting, the number of identified mineral deposits and the relatively low intensity of exploration to date mean that Papua New Guinea should be close to the top of the list of

exploration targets for mineral producers. For all the reasons discussed earlier, though, mineral exploration expenditure is currently at a 25 year low. With all of the current mines but Lihir expected to be closed within 10 years, and new investors wary of involvement in the industry (Highlands Gold being unable to secure a major investor to the Ramu project, for example), a pessimistic outlook for the industry is that there will be just one operating mine in Papua New Guinea in ten years time. Even with the development of Ramu and possibly one or two small-medium prospects over this period, Papua New Guinea's mineral production is expected to fall dramatically over this period due to the lack of current mineral exploration.

There is an argument that given the current inability to translate mineral revenues into sustainable economic development, a smaller minerals sector may be a positive in the interests of the sustainable use of Papua New Guinea's mineral resources. Leaving mineral resources in the ground until such time as governance and management of the sector improves could be a positive step for the country's long-term utilisation of its natural resources. The impact on the national economy, though, will be enormous with a drastic decline in government revenues (the loss of perhaps 30% of internal revenues), a drop in GDP, and the loss of around half of the country's current export revenues. The transition from a mineral-dependent economy would not be simple, and would impact on most sectors of Papua New Guinea society. There is certainly no indication that Papua New Guinea wishes to turn in this direction.

The reasons for this have been discussed above and include the poor global climate for mineral exploration, constant changes throughout the 1990s to the fiscal regime, political interference in mineral agreements, and law and order concerns. Negative overseas publicity attached to Ok Tedi in particular, and a lack of resources for government regulatory bodies compound investor concerns over governance and stability.

The first step towards a solution requires the recognition by the Papua New Guinea State of the extent of the problem. There are indications in the Taxation Review, the recently signed agreements for the Ramu mine, and recent pronouncements of the current Minister that there is a growing awareness of this issue. If this awareness can be translated into a more competitive and stable fiscal regime, and improved governance and regulation of the industry, Papua New Guinea may become a more attractive investment target for mineral exploration, although this is unlikely to occur in the short-term (i.e. within five years).

Diseases and Curses: Management at the National Level

Papua New Guinea is increasingly being used as an example of a country that has not effectively managed its mineral resource endowment. In the period from Independence in 1975 up until the early 1990s, the Papua New Guinea fiscal regime and macro-economic management of resource rents was regarded as a model for developing countries. By the early 1990s, however, it was apparent that Papua New Guinea had been unable to use mineral revenues to transform the structure of its economy away a resource dependent one, and serious problems were evident in terms of management of the sector at the national level.

Clearly while the sector has contributed substantial revenues to the state, the Papua New Guinea government has failed in terms of the fundamental goal of mineral policy as stated in 1977:

> *Papua New Guinea's mineral policy is premised on the view that large mines are not useful for any direct benefits that they bring, but for the financial support that they can provide for progress towards other national goals. … known mineral resources should be developed for the revenue they can provide to the Government (Papua New Guinea Department of Finance 1977:2).*

Auty's (1991:97) comment from 10 years ago that "PNG mineral economy management was weakest in regard to the diversification of the non-mining tradeables sector… especially [in terms of] the manufacturing sector", has been reinforced by events of the last decade. Although the individual mines make a substantial proportion of their purchases of goods and services within the country as discussed above, few new or substantive linkages have been developed between the sector and domestic industry. While they are not the enclaves they are sometimes made out to be, the industry has not been a catalyst for broad-based industrialisation within Papua New Guinea. Given the relatively high wage rates that have prevailed over the period since independence, the initial hard currency strategy and restrictions on foreign investment, and more recent investor concerns over political stability and law and order, it is not surprising that mining has not been a stimulus for Papua New Guinea's manufacturing sector. In the last decade the mismanagement of the revenues from the sector, the increasing dependence of the country on resource rents (anticipated as well as actual), and the relatively poor economic performance of the country all provide evidence for the resource curse argument.

Both internal and external economic shocks (from the closure of Bougainville to the Asian financial crisis) have affected economic growth in Papua New Guinea over the last decade. While GDP growth was high in the early 1990s largely due to resource project investments, the economy has failed to grow significantly since 1994 (?) despite the high value of production from hydrocarbons and hard rock minerals. The fact that there has been no consistent declining trend in the contribution of mining to GDP (nor in the proportion of mineral exports) over the last decade provides further evidence that Papua New Guinea has been unable to translate growth in the minerals sector into other areas of the economy. The contribution of manufacturing to GDP, for example, during the period 1990-2000 has remained between 8-10%, and the agriculture, forestry and fisheries sector has recorded a decline from 29% in 1990 to 24% in 1998.

In terms of the generation of government revenues, the fiscal regime, based around an APT to capture a large proportion of resource rent, has been relatively successful in securing a relatively high proportion of these mineral rents for the government. Having said this, it is significant that this rent capture has primarily been through standard corporate income taxes: the APT itself has only been paid once, by BCL in the early 1980s. This reflects the fact that Papua New Guinea is a high cost environment for mining corporations, and profitability in the sector has been relatively low. Anecdotally it appears that single figure rates of return have applied for the larger mines throughout the latter part of the 1990s, particularly with the depressed metal prices.

The use of the MRSF to minimise fluctuations in mineral revenues to the government has been of only moderate success. Guest (1987) estimates that over the period 1978-87, the MRSF was only able to dampen government exposure to resource revenue fluctuations by just 30%. The value of the Fund was highlighted after the closure of the BCL mine on Bougainville in 1989, when it allowed significant revenue flows to the government in 1990 and 1991 despite very low inflows. In the period since It also needs to be noted also that the MRSF was not intended to act as a trust fund for the accumulation of mineral revenues. Hence Papua New Guinea has never had at the national level any mechanism for the inter-generational transfer of mineral wealth.

While the rationale for the massive drawdown from the MRSF in 1999 cannot be questioned, the repealing of the MRSF Act does leave the Papua New Guinea economy, and particularly the funding of central government activities, highly exposed to production and commodity price fluctuations, and external and internal economic shocks. It also substantially reduces the possibility of diverting some portion of mineral revenues into a sustainable trust fund for the inter-generational transfer of mineral revenues.

This repealing of the MRSF Act was motivated in large part by the recognition that the value of assets in MRSF had declined significantly in real terms in recent years. In 1996 the fund had an end of year balance of US$401.4 million (K531.4 million) but despite an increase in kina holdings, was worth just US$328.9 million (K677.3 million) by the end of 1998. As the Budget Papers for 2000 note, "this shows that while the state's largest monetary asset is in a kina denominated account it will be greatly exposed to any mismanagement of the economy".

A number of authors have pointed out clearly the ways in which countries can work to reduce or avoid the notion of a 'resource-curse'. These arguments have been addressed elsewhere as part of the MMSD process, and need not be covered in detail here. In short they require sound and stable macro-economic policy, including responsible fiscal stability and the stabilisation of revenue flows to national accounts, and the replacement of the income stream from the depleting ore assets, which encourages inter-generational transfer of wealth. In Papua New Guinea's case, such an argument highlights the need for fiscal policy stability and some form of replacement for the MRSF.

Community Issues

There are a number of issues of concern at the community level, several of which are implicated in the conflicts that have arisen from time to time at the mine sites, including Bougainville. These include the distribution and utilisation of revenue flows into the community, issues of representation and participation, and communication between the stakeholders.

Benefit Distribution and Use

The central issue in terms of the revenue flows to communities described earlier are those of equity of distribution and the use of the revenue flows. A large part of the current concern centres on securing and translating some of the compensation and other benefit streams into

more sustainable economic activities. It is useful to concentrate on compensation payments as an example as the amounts paid tend to be very substantial relative to other flows and they are both geographically and temporally uneven.

Compensation tends to be paid in cash and the payments vary enormously in terms of when they are paid, and the geographical spread of whom they are paid to. Currently there are no means to manage this in a sustainable manner. To give a sense of the effect of mine construction on flows of compensation to affected communities, Figure 11 shows the value of compensation paid by quarter at the Porgera mine, 1987-1992. Clearly this has implications for the management of revenue streams that communities receive from mining operations.

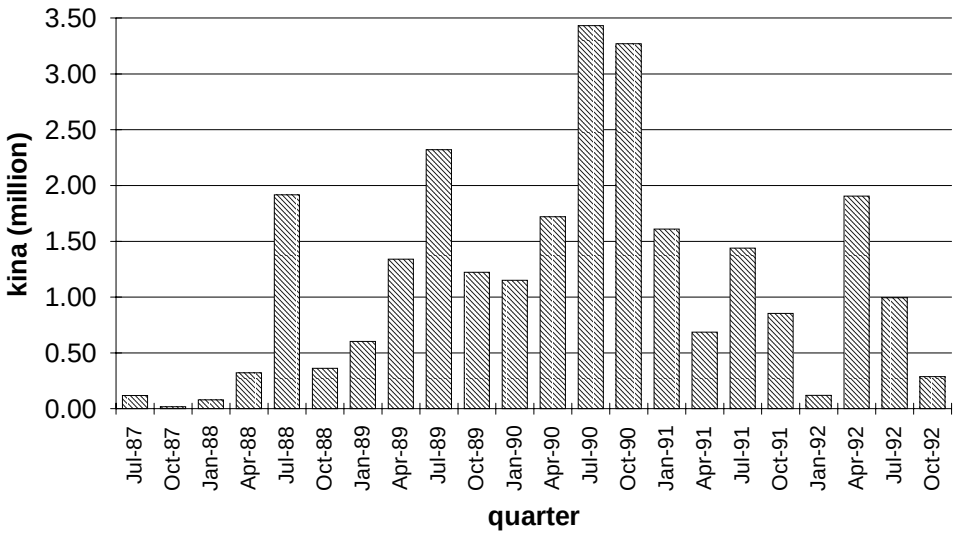

Figure 11: Porgera mine compensation payments by quarter, 1987-1992
(Source: PJV compensation records)

During the period from 1988 to the late 1990s, compensation was an issue of central concern to the industry and government, with 'unreasonable' compensation demands being cited as a constraint on exploration and mine development. The topic provoked a number of legal, industry, and academic investigations and resulted in a series of excellent publications on the issue (see for example Toft 1997 and Filer et al 2000). In recent years, perhaps as a result of the mine operations maturing and other revenue streams becoming more significant, the issue is less to do with disputes over the amounts of compensation, but rather with the management of compensation and other revenue streams.

Compensation (used broadly here to include other benefit streams) is a contested term in relation to mining throughout Melanesia largely because the principle, if not the term, formed a central part of social relations in most of the diverse pre-contact societies across the region. In this traditional context compensation: "has to do with the settlement of disputes between litigant parties, not by violence or imposed punishment but by a voluntary payment or gift which is seen as providing a substitute or replacement in wealth goods for that which was lost or damaged in an earlier phase of the dispute" (Strathern 1993:57).

Traditional forms of compensation flowed from harm or loss, and particularly from harm or loss to persons (Filer 1997:157). In many of the societies compensation in this form was linked into broader networks of exchange, marriage and trade (Strathern 1993:53) and in this sense compensation was an integral part of maintaining relationships between people and between groups. In terms of contemporary mining, compensation still flows from loss or harm, but significantly it is regarded as transactional rather than relational: that is, compensation involves one-off restitution for damage or loss, not something which is integrated into on-going relationships. In terms of mining, the sorts of issues that confront communities affected by mining in Papua New Guinea (environmental degradation, social disruption) are not those for which any traditional precedent exists, in terms of either the amount or the value.

Another issue in terms of the impact of compensation on communities is the distribution of compensation monies. In most cases, community members or representatives are told of upcoming payments to be made, and those who are regarded as the owners of land or improvements arrive on the allotted day to receive their payments. In the case of Porgera, there are often very public negotiations between kinsmen before the drawing up of a distribution list for the payments: neither company nor state plays a role in these discussions. This can be regarded as allowing for traditional forms of distribution to occur, however it does also mean that this process can further attenuate existing inequities in the society. And as Filer (1991) points out, compensation in this form and amount is an entirely new dimension for communities to deal with and there are few traditional precedents that can usefully apply. Tradition, in other words, is often a poor guide for the equitable distribution of these large cash payments, and this can give rise to conflict within the community, and subsequently between disgruntled landowners and the company.

What this discussion highlights is that new structures and guidelines are required to handle the distribution and sustainable use of compensation monies. Some of the new initiatives in this area that may prove instructive include the various trust funds currently employed at Porgera, Lihir and elsewhere, the Ramu and Ok Tedi Foundations (discussed below), and the recent alternative relocation packages used at Porgera (an investment fund rather than a new house). It appears the Sustainability Policy being developed for the minerals sector within the Department of Mining will examine this issue closely and seek to develop solutions.

Representation and Participation

As mentioned earlier, the existing structures for community representation and participation do not provide for the input of all sections of affected communities into discussions and negotiations over the development of mineral deposits. This takes two forms, in terms of the representation of all affected groups within the mine development process, and the relatively static forms of representation that are created by the mine development process. To give concrete examples, the exclusion of downstream landowners from the Ok Tedi mine development consultations illustrates the first issue, while the relatively fixed representative holders that agency agreements creates is an example of the second. Singularly, or in combination these two issues have led to conflicts and contention at a range of intensities at several of the Papua New Guinea mine operations.

While the Development Forum has successfully raised the profile and involvement of host communities in the negotiations over mine developments, participation by other potentially affected communities is weak, particularly those communities downstream. The special status that mining lease landowners hold in terms of participation means their agenda and interests dominate those of other affected communities outside the leases. Even within the most directly affected communities, traditional (and some modern) processes limit the involvement and participation of some groups within the community. The secondary role that women usually play in such negotiations is an obvious example, but other groups such as particular clans or families can also be marginalized by contemporary structures of representation, as they could be within traditional society.

The use of agency agreements to nominate community representatives creates a set of individuals with very few requirements for accountability, transparency or communication with their constituency. The positions are also relatively fixed, with no automatic mechanisms for revisiting the appointment of these individuals. This can create (and has created) problems when, for example, a younger group of better educated community members wishes to revisit the issue of community representation but finds there is no simple way of doing so. The issue can be complicated by the arrival of better-educated migrants who have at times sought to assume a representative role for the community, although they clearly have limited support from within.

The potential for conflict arises if the interests and views of some elements of the affected communities are not adequately presented to, and discussed with, the mining companies and the state. To date the strength of the relationships between the mining companies and the bulk of the local host community has limited the impact of this issue on the mine operations, with the notable and instructive example of Bougainville. Essentially the issue of representation generates contention within the affected communities, although this can potentially impinge of the relationships with the state and the mining companies, as the Bougainville case again illustrates.

Communication Among Local Stakeholders

Linked to the above issue is that of communication. Many Papua New Guinea societies have few if any formal modes or channels of communication. Some, such as the Ipili at Porgera, emphasise private over public forms of communication and the primacy of actions over verbal communication. Rumour is often an integral part of the functioning of the society. In this context, it is not surprising that there are currently relatively ineffective forms of communication between companies and local communities. Most companies rely heavily on local community liaison officers and appointed representatives to relay information to and from the community. The weakness of these channels is their limited scope to spread and receive information to a large network of people given the nature of communication within these societies. As a result, many in the community have a relatively poor understanding of company activities. On the other hand, community affairs sections generally operate better (although still not infallibly) as gatherers of information about the community, and form a more effective channel of communication for management within the companies. Local level government can at times act as a useful mediator of information flows between the

company and the community, although equally personal agendas and interests on the part of public servants have at times worked to attenuate miscommunications.

The potential for conflict arises, and indeed disputes have arisen, through poor information flows and channels of communication between the parties. In the extreme case, at Porgera, rumours of company activities have led to violence and security disturbances. As noted below, a more detailed understanding of the processes of communication between company, community and other stakeholders is required. This is particularly in terms of promoting and pursuing locally relevant forms of sustainable development.

Tailing Disposal

Of all the environmental issues associated with the mining sector in Papua New Guinea, disposal of tailing is the aspect that has generated the greatest controversy. It is certainly the issue that has dominated international debate concerning the industry in Papua New Guinea (and elsewhere). As noted above, all the current and major proposed mines in Papua New Guinea employ either riverine or STD methods for tailing disposal. At, most notably, Ok Tedi this has caused widespread, profound environmental change. While most NGOs and (even several mining companies) view such practices as inappropriate, there are other aspects to the issue in the Papua New Guinea context. In essence, this debate reflects the broader concerns about universal environmental standards verses environmental standards that fit different social, economic and environmental contexts.

There is no doubt that the steep, often unstable landforms, high rainfall and high levels of seismic activity make the retention of tailing more difficult and potentially hazardous in the Papua New Guinea context than in stable, low rainfall environments such as are found in many parts of Africa, Australia, South America and the United States. The same dynamic conditions ensure that the impact of tailing on river systems and downstream environments is comparatively less than it would be elsewhere due to high natural river flows and sediment loads. In the case of Lihir and Misima, the argument against retention of tailings and waste rock includes the extent of land that would be used on small islands with growing populations. Companies, the state, and their environmental consultants, do have some grounds then for arguing that the existing operations conform to a best practice that acknowledges the different environments in which the operations occur.

The debate around STD or riverine disposal hinges on what is an appropriate level of impact from the mines in exchange for the benefits that can be derived at local, provincial and national levels. The different stakeholders obviously hold very different opinions on what this acceptable level of impact is, although there are few who argue that Ok Tedi's downstream impact is reasonable.

One of the key issues in the past was the limited amount of reliable information available on the extent and nature of the impact, particularly given the substantial resources and effort that companies have been required to make in monitoring environmental change. The vast bulk of the data collected as part of these environmental monitoring programmes were not in the public domain, and this heightened suspicions among communities and other stakeholders about the nature and extent of the environmental impact. This transparency has

improved markedly in the last five years, at least for Ok Tedi and Porgera, through the more widespread availability of material and new forums where stakeholders can become involved in assessing and discussing the environmental monitoring data generated. At Ok Tedi, the Peer Review Group (PRG) reports, and a wide selection of other specialist studies are now available on the Ok Tedi web site. At Porgera, the formation of the Porgera Environmental Advisory Komiti (PEAK) has facilitated the involvement of NGOs and communities in the assessment of the company's environmental monitoring data. While significant improvements, both these initiatives have weaknesses, largely due to the fact that they do not overcome a key issue identified earlier: that communication of scientific environmental information is not straightforward in rural Papua New Guinea.

Overall, the environmental management of the sector is certainly better, and the environmental impact less, than it was in the past in Papua New Guinea, and indeed better than it was elsewhere in the world two decades ago. Recent initiatives have seen the broader participation of stakeholders in the evaluation and assessment of the environmental impact of the minerals sector result, particularly in terms of information exchange. Fundamentally differing perspectives, priorities and values will continue to hinder further co-operation on this issue among stakeholders, particularly at the international level, and hence the issue will remain contentious while current practices continue.

3.3 Continuity and Change

A range of interests and factors are influencing the direction and speed of change and reform in the Papua New Guinea minerals sector.

Structural and Political Constraints on Reform

There are a number of conservative factors within the current Papua New Guinea sector at the national political level that are constraints on reform. While not active forces, these related factors (entrenched political interests, lack of effective governance, and economic dependency) provide a great deal of inertia behind current policy.

Mining, Entrenched Interests and Dependency

The increasing politicisation of all levels and arms of government in Papua New Guinea has created a broad, influential group of politicians and public servants who have little interest in reforming the minerals sector. In particular, current mineral policy and the existing use and distribution of mineral revenues supports and protects these interests. At a broad level, this can be seen as expression of a national culture of dependency attached to resource (particularly mineral) revenues. This dependency occurs at national, provincial and local levels, the latter having been discussed earlier. The flows to the state, and the opportunistic ways in which political actors have mismanaged them, has seen the growth and entrenchment of what critical commentators regard a parasitic rentier class within Papua New Guinea society. The notion of Papua New Guinea as a nation of resource rent takers obviously provides little incentive for substantive change in mineral policy, its administration, or in the way in which mineral revenues are used, while these revenues continue to flow. One area where many observers see this economic dependence

influencing management of the minerals sector is in terms of the priorities given to economic rather than environmental concerns associated with the industry.

This issue is closely tied in to the politics of patronage (which are rife in the government system) and the issue of corruption. Everything is political in the current Papua New Guinea context, and the increasing politicisation of the public service (particularly the senior positions) is one expression of this. A concern in terms of mineral policy and the management of mineral revenues is the short-term focus of this patronage. Given the five year election cycles that the country operates under, and the fact that currently on average only half of the elected Members of Parliament (MPs) are re-elected at the following election, there is a focus by many within the system on securing as large a share of benefits as possible within this short time. As a result longer-term planning within many departments has been abandoned, and government administration has been increasingly politicised and less focussed on service delivery. One notable exception to this trend has, ironically, been the Department of Mining itself, which has not been affected to the same degree as most others. The DoM remains well regarded by industry, although the chronic lack of resources referred to above does place limits on its ability to regulate the existing mines and service new investors.

Several commentators have noted that corruption within government only really became obvious with the dramatic increases in mining and oil revenues in the early 1990s, following on the development of a culture of corruption within the forestry sector beginning in the 1980s. While corruption within Papua New Guinea still tends to be opportunistic rather than systematic, the scale and level to which it is permeating is becoming significant. Like the issue of patronage and dependency, the downturn in mineral revenues that would accompany current trends in the industry over the next decade might be the only factor that could bring change in this area.

Lack of Effective Governance

A further constraint to reform is simply the lack of capacity of government. Even if tough decisions are made in terms of policy, overcoming the interests noted above, it may not be possible to carry through or implement new policy because of the lack of resources and capacity within the Papua New Guinea state. One of the outcomes of the politicisation of the state apparatus has been a decline in the capacity of the state to actually implement and enact new policy or legislation. One much cited example of this has been the 1995 Organic Law on Provincial and LLG. The rationale behind the legislation was the need to impose new forms of financial control over a provincial system that was clearly not functioning in a transparent and constructive way. The proposal also saw the transfer of additional powers and responsibilities to provincial and local-level governments and on paper represented a more radically decentralised system of government. In practice, though, the lack of capacity and resources within governments at all levels has meant the major intent of the reforms has failed. While the Organic Law reforms do provide structure within which new initiatives by mining companies are possible (such as those at Porgera described below) the major outcome to date has been the consolidation of power and resources in the hands of national MPs within their own electorates. The implication here for the minerals sector is obvious: radical change in terms of minerals policy, or new directions for the use of resource

revenues at national and local levels, are likely to run into serious difficulties due to the lack of capacity of the state to translate policy into practice.

Key Drivers of Change

A range of external and internal stakeholders is bringing about change within the current Papua New Guinea mineral sector. While it is possible to nominate one or more of the stakeholders as the key agents of change (and this is done below), the processes of change are more dynamic than this. The development of new attitudes to community involvement in environmental monitoring at Porgera can be used to illustrate this. Publicity of local claims of deaths caused by Porgera's tailings, and an initial international NGO-sponsored investigation of these claims in 1995 was followed up by a documentary (based largely on the NGO-sponsored study) on SBS television in Australia. The MPI then published (on the WWW and in hard copy) a summary of the study and the various claims, and various international advocacy journals (Multinational Monitor, for example) also picked up the story. In large part NGOs initiated this work in the wake of the high-profile campaign against the environmental impact of the Ok Tedi mine. The PJV's response was driven primarily by Placer Dome, who at that time were beginning to develop a corporate environmental and community policy based around the notion of sustainability. Soon after the publicity (although PJV staff say the timing was simply coincidental), a major environmental audit and review of the operation was commissioned by the mine from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the key Australian government research institution. This report recommended a suite of changes, covering the approach to, and the mechanics of, the environmental monitoring programme at Porgera. Following this, a new review committee, the Porgera Environmental Advisory Komiti (PEAK) was set up by the PJV to facilitate the greater involvement of community and local and international NGOs in the monitoring of the PJV's progress towards meeting the various CSIRO recommendations, as well as other environmental issues. Earlier this year, dissatisfaction with the scope and progress of reporting to PEAK led the chairman, a Papua New Guinean NGO representative, to resign. In essence, then, changes in the way in which information on Porgera's environmental effects are collected and disseminated is the evolving outcome of corporate, community and NGO interests and agendas.

Four of the stakeholders that appear to be key in terms of change within the industry are the multinational corporate actors, international NGOs, elements of the National Government, and the companies themselves within Papua New Guinea. In the interests of clarity, the first two of these are discussed as external drivers of change, and the latter two as internal.

External

The first of these are **changing corporate cultures, attitudes and policies** at the international level. Two obvious examples of this are the development of a sustainability focus by Placer Dome, and Rio Tinto's policies towards community development and human rights. Like developments in corporate policies at the international level (in relation to health and safety, or financial practices, for example) such policies do have an effect on the way in which subsidiaries and mines that these multinationals manage are operated. Changes at this global level, then, can impact on the nature of operations within Papua New

Guinea in terms of environmental practices and relationships with other stakeholders. In part the motivation behind the shift in corporate positions is reactive, driven by criticism of operating practices by communities and NGOs. There was a sense in the 1990s that the mining industry needed to recapture its public legitimacy, and moves such as the development of community and environment policies by Rio Tinto (along obviously with the MMSD process itself) can be seen in this light. Some of these corporate initiatives can also be seen as more proactive. Placer Dome's development of sustainability reports and policies for each of its mines (including Porgera and Misima), for example, are in part the outcome of a corporate decision to try and strategically position the corporation at the forefront of efforts to recapture public confidence. In this sense they represent an attempt to secure a competitive advantage for the corporation, which critics suggest points to a degree of corporate self-interest in such initiatives.

Closely related to changes within multinational policies and approaches are the **activities of international NGOs**, particularly environmental NGOs. The late 1980s and early 1990s saw a rapidly growing interest by international NGOs in the minerals sector in Papua New Guinea, as well as elsewhere in the Asia-Pacific region. This interest was spurred by growing evidence of environmental and human rights abuses associated with mine sites in the region. Since this time, a network of primarily environmental NGOs has developed within and beyond the region. In the Asia-Pacific, the Minerals Policy Institute has become the most vocal critic of current practices, and has been instrumental in building links with, and the capacity of, NGOs in Papua New Guinea. The impact of this NGO pressure has been most effective when (as in the Ok Tedi case) it can be translated into shareholder concern with existing practices, which in turn impacts on managerial decision-making. The BHP-directed campaign against the Ok Tedi mine run by (largely) Australian NGOs and lawyers is one example of this. Likewise, recent adverse publicity concerning the Ramu Nickel mine's proposed STD system will not assist Highlands Pacific in securing an international partner.

It should also be noted that recent collaborations ('engagements') between some international NGOs (WHO, for example) and mining corporations in Papua New Guinea have led to a greater degree of trust and knowledge of the activities of the other. Both parties indicate that they feel there is scope for greater involvement of NGOs in implementing corporate-funded community projects around mine sites.

Internal

In terms of internal drivers for change, while the constant policy and fiscal regime adjustments of the **National Government** have had a destructive influence on the current state of the sector, other regulatory arms of the government have had a more positive role. The development of a new Environment Act, and the drawing up of a Environmental Code of Practice for the mining industry by the OEC, in consultation with NGOs and industry, has improved the governance of the environmental aspects of the minerals industry. The push by the Department of Mining to develop new policy (as part of the World Bank Technical Assistance Program) can also be viewed as a positive step towards a more sustainable utilisation of mineral wealth. As is acknowledged by the Department, the proposed policy is driven in part by the broader global sustainable development context and various corporate initiatives (as discussed above).

The final drivers of change in the industry are **the companies** themselves. The industry body, the PNGCMP, is an articulate and well-organised advocate of change generally, and has been remarkably responsible in terms of the sorts of issues that it has raised. While the economic and security interests of its members are obviously its key concerns, the PNGCMP has also argued for better governance of the industry, and better mechanisms to ensure fair and equitable benefit distribution at local levels. The individual companies are also central to the development of better governance structures and benefit distribution mechanisms for the local communities around the various mines. At Lihir, Porgera and Ok Tedi the companies have become concerned with grappling with issues of sustainable use of funds and the establishment of community institutions and revenue flows that will continue post-mine. Although in the case of Porgera and (particularly) Ok Tedi these initiatives can be regarded as well overdue, they do offer the prospect of more sustainable local outcomes from mining for the respective communities. The motivation for this is partly self-interest, partly new agendas from higher within the corporate structure (as discussed above) and partly the concerns and efforts of individuals within the companies, particularly those in the community affairs sections of the various mines. It is driven in part by the recognition that at the local level, the institutional structures and capacity simply do not exist to secure and translate revenue streams into longer-term sustainable forms of development. This issue is regarded as posing a social risk to the mining operations, and hence is an issue of concern to the industry.

3.4 New Directions and Initiatives Proposed or Currently Underway

Three areas where new initiatives of note are proposed or currently underway are the development of a National-level Mine closure policy and guidelines, a sustainability policy for the minerals sector, and some of the initiatives occurring in terms of the relationships between mining corporations and local communities and governments.

Mine Closure Policy

The Department of Mining and the Office of Environment and Conservation drew up a draft policy and set of guidelines for Mine Closure in late 2000. This comprehensive document seeks to ensure that mine closure is an integral part of mine development and operational planning. There is provision for mine closure bonds and trusts, and detailed guidelines for both physical (environmental) and social aspects of mine closure. Following discussions with industry, NGOs and government departments, and the receipt of a World Bank loan for mining sector institutional strengthening, the social aspects of mine closure were incorporated into the development of the sustainability policy, discussed below. The mine closure policy has not subsequently been finalised, but will now only cover the physical environmental aspects of mine closure. It will require developers to provide detailed plans of progressive rehabilitation, the physical closure process, post-mine landforms, environmental indicators, and long-term monitoring programmes. The plan will be updated periodically (in line with reviews of the mining plan) to take account of changes in the mine operation or context.

Sustainability Policy

The development by a national government of policy specifically focussed on sustainability in relation to the minerals industry is virtually unheard of, particularly for a developing country. In Papua New Guinea's case this has been facilitated by the receipt of a World Bank loan towards the cost of a mining sector institutional strengthening project. One component of this project is the development of a sustainability policy, in the recognition that a lack of such a policy or strategy will cause major impacts at both local and provincial levels. As noted in the previous paragraph, the sustainability policy will focus on the social aspects of mine development and closure, complementing the environmental focus of the mine closure policy and planning.

According to the ToR for this work, the development of this sustainability policy will focus on:

- The definition and measurement of the economic sustainability of the industry and the implications of this for communities.
- Defining the interface between the social and environmental impacts.
- Effective arrangements for benefit distribution.
- Developing systems or institutions to ensure the development initiated by a mine project can be sustained after mining ceases.
- The identification and establishment of sustainable income replacement economic activities for communities post-mine.
- Measures required to sustain essential services provided by the mining company beyond mine life.
- The creation and management of long term funds to provide resources for the continuation of sustainable development activities.

This sustainability policy development process is currently at the selection of consultant stage, and work is expected to begin in November 2001. It is anticipated that the policy development process (including the drafting of required legislation) will be completed by the end of 2002.

Local Level Initiatives at Various Mine Sites

The mining companies at Porgera, Lihir, Misima and Ok Tedi are currently reshaping the nature of their relationships with local communities. This is occurring for a range of reasons: the lack of substantive sustainable transformations of local communities and local-level governments after up to a decade or more of large-scale mining; parent-company initiatives; the approach of closure; and, to a lesser extent, community and NGO pressure. This change is being made largely through an examination of the institutional setting within

which this relationship occurs, with a particular focus on the sustainability of local economies and administrative structures. Trust funds are being used increasingly, for both community members and groups, and for the up-keep of infrastructure post-mine.

Conceptually we can see these as a continuation of the Tax Credit Scheme (TCS) as they are an acknowledgement that long-term governance structures around mine-sites are inadequate to ensure that fair, equitable and sustainable use is made of the benefits derived from mining operations. They are also closely related to, and acknowledged as an influence on, the development of a sustainability policy for the industry as described previously. Three of the most advanced of these processes are outlined below: the Porgera, Ramu and Ok Tedi cases.

At Porgera, the PJV has been working closely with the District Administration to resource and develop a **Porgera District Plan**, the primary goal of which is to develop a viable long-term socio-economic environment that is sustainable after the life of the mine. The company aims to provide additional resources and capacity for local administrative structures and establish what will hopefully become durable economic, social and administrative institutions and activities. At the core, the Plan proposes a Porgera Plan Management Team comprising representatives of the PJV, the Porgera Development Authority (PDA) and the District Administration. This team will be responsible for the development and implementation of the Plan, in addition to liasing and communicating with local stakeholder groups. Community development resources currently deployed by the PJV would be channelled through the Porgera Plan, along with existing forms of funding for the PDA and the District Administration. In this way the capacity of local government is enhanced through the use of PJV resources and expertise, and the focus of development directed by Placer's concern with sustainability. The Plan will comprise a series of rolling five year sectoral plans covering health, education, infrastructure, justice, primary industry, and industry and services. Each of these sectoral plans will be developed with local community input and include specific goals for the period. Monitoring, auditing and evaluation will be central to the Plan, and will occur at a range of levels, from annual internal reviews to formal external evaluations of programmes and plans.

The advantage of this approach is that it seeks to work within the existing framework, as District Plans are meant to be prepared in any case. What is new is the formal structure, the management team and the resources of the mining company, all of which appear to facilitate the production of a Plan, although as the key players are finding the process is a lengthy one.

At both Ramu and Ok Tedi, the companies involved have decided to advance similar objectives to the Porgera case through the use of **Foundations** (Ramu Nickel Foundation – RNF – and Ok Tedi Development Foundation – OTDF, respectively). In the Ramu case, the MOA between stakeholders contains a clause that requires the RNF be established to manage a Social and Economic Development Plan for the area. The intention is to ensure that benefits from the mine are utilised for long-term sustainable development in the project area. In the OTDF case, the Foundation is seen as a way of formalising and externalising OTML's commitments to the community and delivering long-term sustainable development, particularly on issues that OTML have identified as critical in Western Province – food security, economic development, capacity building and infrastructure development.

While there are some variations between the two Foundations as proposed, the key objectives are similar in that both seek to direct funding from mine benefits, government sources and, potentially, external donors, through an independent institution that is jointly managed by the mining company, and various local, provincial and national government agencies. LLG and Provincial governments are brought into the process, and the aim is for co-ordinated local-level development planning, with a specific focus on the delivery of long-term sustainable benefits.

These Foundations seek to work around the lack of capacity at local and provincial levels. This is in contrast to the Porgera Plan that seeks to strengthen the existing system rather than introduce a new institution. Ok Tedi argue that the OTDF will not undermine the role of LLG and Provincial government, but rather will enhance the ability and capacity of these institutions to deliver development to the people who elected them. However, it is difficult to see how a well-managed and effective new institution will revive LLG or Provincial government: a further lack of relevance of these local governments as development delivery agents is likely. One result is that unless carefully managed, conflicts with the existing institutions and their agents (particularly the elected members) are likely.

The Foundations also raise the issue of whether mining companies should externalise their community development role. OTML argue, for example, that they are a mining company, not a development agency. Hence the establishment of an independent institution will, they argue, allow for a more focussed community development programme and greater co-ordination with other institutions, particularly LLG. However, this externalising of community affairs also has the result of weakening the direct relationship between communities and companies. Elsewhere, such attempts to do this have met with scepticism from communities, who see it as an attempt by companies to reduce the extent of their relationship with the affected communities.

3.5 Broader Lessons from Papua New Guinea

The Papua New Guinea mining industry has experienced a boom in the past decade, and despite problems detailed above, has continued to operate, in places very successfully for most stakeholders. Given this experience there are a number of key areas where in particular the structure and management of relationships between stakeholders in the Papua New Guinea industry could provide positive models applicable more widely.

Four of these are:

Development Forum

The Development Forum concept was initiated in 1988 for the Porgera mine. At the time it marked a departure for the Papua New Guinea sector in that landowning communities and provincial governments had not been actively involved in negotiations over new mineral developments. The Development Forum grew out of recent experience in the approval process for the Misima mine. In the Misima case Department of Minerals and Energy (DME, as it was then) staff discovered that there was pressure by Ministers and the Provincial government to become involved in the negotiations over the mine at a late stage.

This gave rise to a departmental view that all key stakeholders should be involved in discussions concerning a potential mine from the time that the developer submits a proposal for development.

In late 1988 the first Development Forum was convened for Porgera, and included the following invitees:

- Prime Minister (chairman)
- Deputy Prime Minister (Deputy chairman)
- Minister for Mining (Secretary)
- MPs from the province
- Provincial Governor
- Other Ministers whose departments are involved or affected
- Landowners' representatives, including a representative of the LLG
- Company (developer) representative
- Support staff from relevant agencies

Subsequent to Porgera, the Development Forum concept was incorporated into the 1992 Mining Act, and retrospectively applied to other existing mining projects. It has also been applied to the two subsequent mine proposals – Lihir and Ramu. Section 3 of the 1992 Mining Act states, under the heading 'Consultation', that:

> *A development forum shall be convened by the Minister before the grant of any Special Mining Lease [SML] to consider the views of those persons whom the Minister believes will be affected by the grant of that SML and shall be conducted by the Minister according to such procedures as will afford a fair hearing to all participants.*

The Act then goes on to state that the minister shall invite persons who will fairly represent the views of the developer, the landowners of the SML and other leases required, the National Government, and the relevant provincial government. Two points to note regarding this legislation are first, that the Development Forum is a form of consultation, not a forum for the modification of the proposals for development, although this does occur to an extent. It is also not a right of veto for the various parties, although of course the Minister may decline to grant a SML. Second, only those with interests within the mining leases themselves are to be involved: neighbouring or downstream parties (landowners, LLG and provincial governments, for example) are not included under this legislation.

The outcomes of the Development Forum take the form of a series of three Memorandum of Agreement (MOA) between the landowners, the provincial governments and the National Government. They typically cover issues such as the provision of infrastructure,

the delivery of government services including local staffing, the breakdown of royalty payments, funding commitments, and the provision of equity for local communities and provincial government.

During the Development Forum for Porgera, the developer made only a brief appearance, although at Lihir their role was more substantive. The MOA for larger projects arising from the Development Forums to date have not included the developer as a signatory, although there is a push by landowners and the DoM to see this occur. Currently the developer is only a signatory to the Mine Development Contract (MDC) with the National Government and not the MOAs, although the MDC generally covers the issues raised in the various MOA.

To date the Development Forums have functioned well. They have been instrumental in achieving a higher level of participation by local communities, LLG and provincial governments in the mine development process. Although they are convened to discuss proposals for development, their focus to date has been on the distribution of benefits between the Papua New Guinea stakeholders (in terms of services, revenues and infrastructure) from the development rather than the nature of the proposed development itself. They have generally not imposed additional constraints on the developer, and it is the National Government that has conceded most at these forums. The Development Forums have been successful at securing a greater level of community support for the mine development, and further refinement of the focus of the MOAs could provide a greater degree of sustainable development for local communities.

Communication and Relationships

The complexity of the relationships that occur around mine sites in Papua New Guinea has given rise to a number of different ways of communicating and negotiating between companies, communities and other stakeholders. It is noted in the following section that communication processes around the mine operations are both poorly understood, particularly in terms of how communities receive information from the mining companies, and occasionally problematic. Having said this, there are some concepts and new initiatives that have been successful and may be usefully deployed more widely.

The Porgera mine uses a number of different means of communicating with local stakeholders. These various channels seek to either provide information to other stakeholders, or receive information about the community, or both. Some of the more significant of these are:

- The Community Issues Committee, a monthly meeting where 23 SML landowner representatives, local government councillors from elsewhere in the valley, and LLG representatives meet with company management and staff to discuss issues of concern to any of the parties. The strength of this forum is that company management stay in touch with community concerns. The weakness of the process is that the community representatives in particular often do not report back to their communities, particularly if the information is not positive.

- Regular meetings between mine management and the Porgera District Women's Association and youth representatives. These were initiated by the mining company in response to the weaknesses of the CIC forum as a means of passing information into the community. Again they provide a two-way channel for information.

- Community Relations Officers (CROs) employed by the mine seek to both pass information into the community, and provide community information for the company management.

- The Community Affairs Department (including Business Development, Community Relations, and Social sections) has a total staff of 120 and spends a large amount of its time and resources dealing face-to-face with community members across the whole span of its operation. This provides the most immediate and usually accurate information for both community and company.

- Local mine employees provide an important source of information for the community, although their employer may not officially sanction this information.

- The company's Ipili Wai Pii newsletter and other material for more local audiences provides information for the community.

- At a more general level, quarterly meetings between government, community representatives and company provide a forum for the airing of information and complaints, although in recent years the focus has been on the latter.

- The Porgera Environmental Advisory Komiti (PEAK) was established by the company as an independent body in 1996 to provide a greater degree of communication between the PJV and, particularly national and international NGOs. While there has been some dispute over PEAK, particularly in terms of its mandate, the forum appears to provide the basis for more useful interactions between mining companies and external stakeholders.

Recent moves to increase the transparency of corporate reporting at Ok Tedi have seen a number of consultants reports on environmental and social aspects of the mine made publicly available via the internet. This is a positive model in terms of communicating between companies and external stakeholders, particularly for an international audience.

Local Level Initiatives

Although the initiatives discussed early are relatively new, they appear to represent models that may have wider applicability, particularly in settings where local-level governance is poor. They entail the corporations becoming more proactive in promoting the translation of the community revenue flows from the mines into long-term sustainable economic, social and political development. The methods being employed focus on facilitating and nurturing the capacity of local-level government and institutions so they are able to deliver, on a sustainable basis, community level development. This is an important shift in emphasis from previous corporate efforts that had sought to directly provide local-level infrastructure

and governance. The TCS is a good example of this earlier approach. The TCS operates on the assumption that local-level governance is poor and unable to effectively deliver services and benefits to local communities, therefore the companies, in consultation with national and provincial authorities, will provide the resources and capacity to construct infrastructure, in return for tax credits from the national government. The new corporate initiatives discussed earlier seek to avoid assuming the role and responsibilities of government but rather focus on increasing the capacity of LLG to deliver mine-derived benefits in a long-term manner. While these initiatives appear to offer a model the creation of sustainable local administrations, they are still all at early stages of development and implementation and their success will only become apparent in the medium-term.

Sustainability and Mine Closure Policy

As mentioned above, the development of Mine Closure and Sustainability Policies for the minerals sector in Papua New Guinea are initiatives that may, over the next 12 months, offer positive leads for other countries. In this sense Papua New Guinea may again become a policy leader in the global minerals sector, a position the country occupied in the mid-1970s and into the 1980s, but which has slipped badly in recent times. Like the various LLG initiatives discussed above, the real test of this policy development will occur in the future if and when it is implemented. In the meantime, the fact that such policies are being developed may provide a spur to other countries to also look seriously at the issues involved.

Part Four: The Way Forward

4.1 Introduction

In this section, a brief analysis of the key areas where substantial and significant gaps in knowledge, policy, practice and capacity occur is followed by an outline of some areas where future work (in terms of research and/or policy development) is recommended.

4.2 Gap Analysis

Based on the description of the sector and the challenges facing it given above, there are a number of areas where knowledge, policy and practice in relation to the sector could be improved.

Knowledge

While there has been a raft of studies and reports on various aspects of the industry, particularly in the last decade, the understanding of a number of critical aspects of the industry is still relatively thin. These include:

The Economic Impact of the Industry at the National Scale

Somewhat surprisingly there is no comprehensive examination of the full economic impact of the industry at the national level. The recent mining and hydrocarbon fiscal review drew largely on Internal Revenue Commission figures, and did not, for example, calculate the contribution of the personal income taxes of mining company employees, nor import duties paid by the companies. This information, which appears to be available through the companies themselves, would provide a more accurate indication of the extent to which the sector contributes to overall government revenues. Likewise the extent of economic linkages between the mining operations and national businesses has not been fully explored. Given its centrality to the formal economy, and the anticipated decline in the scale and contribution of the industry over the next decade, this type of information would be extremely useful for government planners and policy makers.

Revenue Flows and Utilisation at the Local Scale.

There is a need for more information on the nature and extent of different income streams to local and provincial governments, the distribution of these monies, and the patterns of revenue utilisation. Some of this information is available, and detailed case studies have been carried out at Porgera (local-level) and Ok Tedi (Provincial scale). An assessment of how these revenues can be used more sustainably requires a more complete knowledge of the variations that exist within the sector. In particular more information is required on:

- The nature and amount of various local and provincial income streams at each of the mine sites over time.

- The mechanisms of distribution and utilisation of these income streams.

- An assessment of the contribution that these revenues currently make to local economic sustainability, and the constraints to making them more sustainable.

- An assessment of models (internal or international) for more sustainable forms of revenue distribution and utilisation.

Processes of Change in Communities

While there have been a number of detailed, quality studies on processes of community change in Papua New Guinea, the vast majority of these have been limited in terms of the time period over which the research has been carried out. What is missing are longitudinal studies of affected communities that draw together material on social and economic change at the household and community levels, political and cultural change including the dynamic processes surrounding group identity and representation, conflict generation and resolution processes, and the changing expectations and experiences of the rapid development that mining brings.

Communication

Linked to the above issue, there is a need for more detailed work on the form and effectiveness of current mechanisms for communication between mining companies, LLG and affected communities. While this issue appears to be problematic, with a particular problem being the provision of regular, widely disseminated and understood information on the companiy's activities and initiatives, there is no comprehensive survey of the methods employed by companies and the state at the various mine operations or their effectiveness. Effective communication between the parties is obviously a prerequisite for the development of sustainable local development, as both company and community need to ensure that their respective interests in this form of development are clearly understood by the other. Without this understanding, few initiatives in this area are likely to succeed.

Long-Term Impacts on Flora, Fauna and Water Quality

In environmental terms the environmental monitoring programmes from the various mines have produced, and continue to produce, vast amounts of high quality data. While transparency is much improved in relation to access most of this material, there is still a need to see this drawn together and summarised more effectively for various stakeholders. One area where there is still uncertainty is in terms of the longer-term impacts of current waste disposal practices on water, soil and vegetation. Concerns have been raised regarding the impacts of, for example, metals in the environment, the ability of die-back due to tailings deposition to recover, and the longer-term management of ARD. This is partly due to the relatively limited time scale in which this environmental data has been gathered. Decades of post-mine monitoring will be required for a detailed understanding of these impacts. One possible source of useful data, if the area becomes open for scientists, is in the Jaba River, downstream from the site of the Panguna mine. This area is one where a project working closely with the local community could yield valuable data on the resilience of these environments and their ability to recover from mining impacts.

Policy

There is a need for a more coherent policy focus within Papua New Guinea in terms of the minerals sector. The ad hoc and yet fundamental changes to the official stated policy of 1977 need to be formally assessed and made explicit within a framework that outlines the country's objectives in terms of mineral developments. This would address issues such as the overall role for the minerals sector in economic and social development, goals for the environmental regulation of the industry, the roles and responsibilities of the various stakeholders, and the rationale behind the distribution of benefits from the sector. It would ensure, for example, that if the industry is to continue to play a leading role in the economy and society, that a commitment is made by central government to adequately resource the regulation and governance of the sector. The development of a Sustainability Policy for the sector that is due to begin shortly is to be applauded, however for this to have its fullest effect, it is necessary to ensure that this policy fits coherently in to the total mineral sector policy environment.

Practice

Three areas where efforts by corporations and governments can be targeted to improve practice are in terms of communication, links between local authorities and the mining operations and social monitoring.

Communicating with Stakeholders

Despite the lack of a detailed, comprehensive survey of the ways in which communication between the stakeholders, particularly between companies and local communities, is handled there is definitely scope for improvement in this area. NGOs in particular may be able to suggest models for better communication and consultation between the various interest groups. As noted earlier, effective communication between companies and communities of their respective interests and objectives is a prerequisite for effective progress towards sustainable development. There are some initiatives in the area that could have wider applicability. At Porgera for example, company management began regular formal meetings with the local women's and youth associations due to rising frustration at the lack of effective communication offered by the appointed agents. The issue remains problematic, however.

Effective initiatives for improving dialogue and facilitating better and more effective multi-stakeholder discussions will need to address the fundamental questions of representation and forms and patterns of communication within Melanesian societies that have been noted earlier.

Links with LLG and Provincial Government

As noted above, companies are now placing considerable emphasis on working with and improving the effectiveness of LLG in areas around their mine operation. It is recognised that effective and sustainable institutions and revenue flows are critical to the delivery of

long-term community benefits. What is not clear at this stage, given the embryonic form of these initiatives, is which factors are most critical to effective multi-stakeholder, local-level programmes of this type. Neither is it obvious which of the approaches currently being tried will yield the greatest long-term, equitable benefits for communities. This is flagged as an area where practice is evolving and largely experimental. As such there will no doubt be scope for improvement and refinement over the next few years.

Role of Social Assessment and Monitoring

Coming out of the existing social impact assessment work in the Papua New Guinea minerals sector (which in itself needs to be better integrated into the mine development requirements) has been the adoption of the rhetoric of social monitoring. Most of the Environmental Monitoring and Management Programmes (EMMPs) for the current mines contain a requirement (typically a vague one) for some form of social monitoring. This is generally involves regular reviews of the compliance of stakeholders with agreements and more broad reviews and analysis of social, economic and cultural change in the community. In a few cases, social monitoring programmes have generated the most detailed information on community change around mine operations in Papua New Guinea. To date, though, social monitoring has not been effectively employed at any of the mine operations. Its application has been irregular, corporate support has waxed and waned, and government enforcement of requirements has been weak.

If developed effectively, a social monitoring programme can significantly enhance the ability of all stakeholders to contribute to more effective local development. Social Monitoring programmes and models have been developed that seek to provide relevant information to LLGs and multi-stakeholder forums for improved planning processes and service delivery. Social monitoring in some shape or form needs to become an integral part of the initiatives currently underway for strengthening the capacity of LLG to deliver sustainable local development. An effective set of social monitoring programmes at the various mines would facilitate the improved exchange of information on mining operations and their impacts amongst communities and other stakeholders. From this basis, planning for locally based sustainable development could proceed in a more informed manner. The information would also allow the National government to more effectively target particular issues or practices in the minerals sector that it considers require better management or control.

Capacity

Three areas of significance where capacity needs to be strengthened to enhance the ability of the minerals sector to contribute to sustainable development are:

Government Regulators

As would be obvious from the discussion earlier, the capacity of the Department of Mining and the Office of Environment and Conservation to perform their respective roles effectively have been substantially undermined by a chronic lack of resources. Unless these departments are funded to a level that reflects the contribution of the industry, it is hard to foresee the industry being anything more than a temporary source of revenue for the

government and the country. A greater role and improved capacity for these arms of government would allow the government to more effectively assess and channel the contribution of the current industry across a wider spectrum of social and institutional spheres.

Community Affairs sections

Increased resources for Community Affairs sections or departments may be required at some or all of the mine sites as these arms of the corporations assume broader roles and responsibilities in terms of sustainability planning and implementation. This may include, in particular, new staff with particular expertise in the development of local institutional and administrative structures, sustainable economic activities, health, education and training. While much of the focus of the recent initiatives discussed above is towards increasing the capacity of LLG to cover these issues and areas, it is likely that corporate community affairs sections will be required to provide support in these areas, at least in the short to medium term.

Provincial Government and LLG

This is without doubt the most critical area in terms of capacity. The ability and resources of LLG and Provincial Governments to deal with their additional responsibilities under the 1995 Organic Law has been demonstrated to be very poor in the period subsequent. Given the poor performance of most LLG and Provincial Governments hosting mine operations since 1995 in managing and utilising effectively the revenue flows generated by the mines, this is an area where improvements are necessary before local-level benefits can contribute to broad-based sustainable local development. As noted earlier this has been recognised by the industry, and a number of mines (Porgera, Ok Tedi, Lihir and Ramu) are currently involved in reshaping the relationships they have with LLG and Provincial governments.

4.3 Moving Forward: Proposals for Future Directions

The following suggestions for change concentrate on those aspects that the sector has a direct interest in: recommendations for broad-based improvements to government capacity, for example, are unlikely to be within the scope of the MMSD project, however necessary they may be to achieving the projects aims. It is hope that what follows can be used as a framework for generating a more co-ordinated approach to research and policy development within the Papua New Guinea minerals sector.

Research Agendas

Derived from the gaps in knowledge listed earlier, research priorities should include:

- The economic contribution of the industry at the national level. A broad and comprehensive review of the contribution that the sector makes in terms of government revenues (including personal income taxes and import duties, for example) and the economy more generally (linkages with other businesses) is urgently required as the

basis for planning for the likely decrease in the size and contribution of the sector over the next decade.

- Local processes of change. More research is required on, broadly, community change around large-scale mine sites over extended time periods. This work needs to cover demographic, social, economic and cultural change at community and household levels, and would address issues such as the dynamics of local group identity, membership and boundaries (land and social), leadership and representation, and the evolution of local understandings and expectations of development processes.

- Relationships between companies and communities. Further detailed case studies, particularly longitudinal studies, are required on the way in which relationships between companies and communities develop and evolve. This would take in issues of the economic relationship (compensation and other benefit streams), communication between the parties, the scope of corporate social responsibilities, and the role of various local, provincial and national institutions in enhancing or weakening the relationship between company and community.

- Long-term environmental impacts. A critical component of any push for a greater contribution of the sector to sustainable development rests on a fuller understanding of the long-term environmental impacts of the existing mines. This includes the impact of metals on the environment and the impacts on flora and fauna, both during operations and in the post-mine period. As noted earlier, there may be scope for an innovative, community-centred environmental research programme in the areas affected by the BCL Panguna mine. Collaborations between national and international research organisations and the mining companies in this area should be supported.

Policy Reform

Two areas where priorities should be targeted in terms of policy reform are:

- Fiscal regime reform. There is widespread agreement that the recent changes to the fiscal regime under which the industry currently operates is no longer competitive internationally. Given the current extremely low levels of exploration expenditure, and clear messages that the most recent raft of changes introduced measures that act as disincentives to new investment, reform is required. While it is probably an anathema to the investment community to suggest yet more changes to the fiscal regime, the reform to the APT and the reduction in the TCS limit are issues that need to be rethought in the light of attracting additional exploration and development investment. The current minister for mines recently indicated in Parliament that he will be taking these issues up with the Prime Minister. As part of this review, the issue of intergenerational transfer of resources should be looked at, with a view to re-establishing a stabilisation and/or investment trust fund for at least a portion of current government mineral receipts.

- Sustainability Policy development. This World Bank funded initiative should be applauded and supported, although as noted earlier the relationship between this policy and other government policy towards the minerals sector needs to be carefully thought

through. In particular there is a need to tie this Sustainability Policy in with Environmental Policy, and broader National development issues. Key issues that the Sustainability Policy should be concerned with are mechanisms for benefit distribution (including intergenerational transfer of benefits at the local scale), mechanisms for enhancing sustainable use of benefits at local levels, and local-level governance in mining areas. The policy development process may also contribute to the development of mechanisms to ensure more effective and sustainable use of mining revenues at the national levels, particularly in terms of intergenerational transfer of revenues.

References

The following are a set of key references on the Papua New Guinea minerals industry covering a range of issues and from a range of perspectives. For a more extensive bibliography of the Papua New Guinea minerals sector please see the Resource Management in Asia-Pacific web site at: http://rspas.anu.edu.au/rmap/

Auty, R. (1993) Sustaining Development in Mineral Economies: The resource-curse thesis. London, Routledge.

Ballard, C. (1994). "The centre cannot hold: Trade networks and sacred geography in the Papua New Guinea Highlands." Archaeology in Oceania 29: 130-148.

Ballard, C. (1996) "Citizens and landowners: the contest over land and mineral resources in Eastern Indonesia and Papua New Guinea" in Denoon et al (eds): 76-81.

Ballard, C. (2000) "The fire next time: the conversion of the Huli apocalypse." Ethnohistory 47(1): 205-225.

Banks, G. (1997) Mountain of Desire: Mining Company and Indigenous Community at the Porgera Gold Mine, Papua New Guinea. Unpublished PhD thesis, Canberra: Department of Human Geography, Research School of Pacific and Asian Studies, The Australian National University.

Banks, G. (1998) "Compensation for communities affected by mining and oil developments in Melanesia", Malaysian Journal of Tropical Geography, 29 (1): 53-67.

Banks, G. (in press) "Mining and environment in Melanesia: Contemporary debates reviewed", The Contemporary Pacific.

Banks, G. and C. Ballard (1997) The Ok Tedi Settlement: Issues, Outcomes and Implications. Canberra, National Centre for Development Studies and Research Management in Asia-Pacific, Research School of Pacific and Asian Studies ANU.

Banks, G. and S. Bonnell (1997) Porgera Annual Report, 1996. Unpublished report to the Porgera Social Monitoring Committee.

Barwick, R. (1999) "The current mining fiscal regime and its impact on the industry". Paper presented at the Fifth Mining and Petroleum Investment Conference, Sydney, 29-30 November 1999. 18pp, available on Conference CD from the Papua New Guinea Chamber of Mines and Petroleum, Port Moresby.

Burke, G. (2001) Draft action proposal for institutional strenghtening of the small-scale Mining Branch, Mining Division, Department of Mineral Resources. Report for European Union Sysmin Project for Mining Sector, Papua New Guinea.

Burton, J. (1991a). "Local Organisation in Porgera: Ipili lines of descent and Central Highlands clans compared." Unpublished paper presented at the New Perspectives on the Papua New Guinea Highlands Conference, Canberra.

Burton, J. (1991b) Porgera Census Project, Report for 1990. Unisearch PNG for Lands and Community Relations, Porgera Joint Venture.

Burton, J. (1995) "Condemned forever to fight? Social mapping at Hidden Valley, Upper Watut CD, Morobe Province, Papua New Guinea." Unpublished paper presented in the Mining in Melanesia seminar series, The Australian National University, Canberra.

Burton, J. (1997) "The principles of compensation in the mining industry," in S. Toft (ed.) Compensation for Resource Development in Papua New Guinea. Port Moresby,

Canberra: Papua New Guinea Law Reform Commission: National Centre for Development Studies, ANU: 116-136.

Burton, J. (1998) "Mining and maladministration in Papua New Guinea," in P. Lamour (ed.) Governance and Reform in the South Pacific. Canberra: NCDS, The Australian National University.

Byford, J. (2001) One Day Rich: Community Perceptions of the Impact of the Placer Dome gold mine, Misima Island, Papua New Guinea. Report for Community Aid Abroad. April.

Cook, A. (1996) "Appendix E: Environmental aspects of the mining and petroleum industry in Papua New Guinea", in The Economy of Papua New Guinea 1996 Report. Canberra: AusAID, International Development Issues No.46.

CSIRO Australia: Environmental Projects Office (1996) Review of Riverine Impacts: Porgera Joint Venture. Canberra: CSIRO Environmental Projects Office.

Daniel, P. (1985) Minerals in Independent Papua New Guinea: Policy and Performance in the Large-Scale Mining Sector. Canberra, National Centre for Development Studies, The Australian National University.

Daniel, P., K. Palmer, A. Watson and R. Brown (2000) Review of the Fiscal Regimes for Mining and Hydrocarbons. A report commissioned by the Asian Development Bank for the Papua New Guinea Tax Review. October.

Denoon, D., C. Ballard, G. Banks and P. Hancock (eds.) Conference Proceedings: Mining and Mineral Resource Policy Issues in Asia-Pacific. Prospects for the 21st Century. Canberra: Research School of Pacific and Asian Studies, The Australian National University.

Department of Mining (2000). Mining Division, Quarterly Bulletin: July-December [sic] 2000. Port Moresby, Department of Mining.

Dove, J., T. Miriung, and M. Togolo (1974) "Mining Bitterness," in P. Sack (ed.) Problem of Choice: Land in Papua New Guinea's Future. Canberra: Port Moresby, Australian National University Press: Robert Brown and Associates: 181-189.

Duncan, R. and I. Temu (1995) "Papua New Guinea: longer term developments and recent economic problems." Asian-Pacific Economic Literature 9(2): 36-54.

Filer, C. (1990) "The Bougainville rebellion, the mining industry and the process of social disintegration in Papua New Guinea." Canberra Anthropology 13(1): 1-39.

Filer, C. (1996) "The Melanesian Way of Menacing the Mining Industry," in B. Burt (ed.) Environment and Development in the Pacific. Canberra: NCDS, The Australian National University.

Filer, C. (1997) "Compensation, Rent and Power in Papua New Guinea," in S. Toft (ed.) Resource Compensation in Papua New Guinea. Canberra and Port Moresby: NCDS, The Australian National University and The Papua New Guinea Law Reform Commission.

Filer, C. (ed.) (1999) Dilemmas of Development: The Social and Economic Impact of the Porgera Gold Mine 1989-1994. Canberra, Port Moresby: Asia-Pacific Press and National Research Institute.

Filer, C., D. Henton and R. Jackson (2000) Landowner Compensation in Papua New Guinea's Mining and Petroleum Sectors. Port Moresby: PNGCMP.

Flew, S. and R. Paika (1996) "Editorial: Health and Major Resource Developments in Papua New Guinea: pot of gold or can of worms at the end of the rainbow?" Papua New Guinea Medical Journal 39: 1-5.

Gardner, D. (in press) "Continuity and identity: Mineral development and land tenure among the northern Mountain Ok," in J. Weiner and A. Rumsey (eds.) Mining and Indigenous Lifeworlds in Australia and Papua New Guinea. Bathurst, Australia: Crawford House Publishing.

Guest, J. (1987) "Problems in Managing the Mineral Resources Stabilisation Fund." BPNG Quarterly Economic Bulletin 15 (2):17-24.

Gupta, D., T. Deklin and C. Yala (1995) Issues in Mineral Exploration in Papua New Guinea. NRI Discussion Paper No. 85. Port Moresby: National Research Institute.

Hancock, G. (2001) "Mining and sustainable development: The status of mineral policy in Papua New Guinea" in G. Hancock (ed.) Proceedings, PNG Geology, Exploration and Mining Conference, 2001. Carlton, The Australasian Institute of Mining and Metallurgy: 117-133.

Hancock, G. and T. Omundsen (1998) "The development forum process and the approval of large mining projects in Papua New Guinea." Proceedings of the World Bank Asia-Pacific Conference on Mining and the Community. Madang, July. 7pp.

Healy, A. (1967). Bulolo: A History of the Development of the Bulolo Region, New Guinea. Canberra and Port Moresby, New Guinea Research Unit, The Australian National University.

Hirsch, E. (2001) "New boundaries of influence in highland Papua culture, mining and ritual conversions." Oceania: 1-14.

Hughes, P. and M. Sullivan (1988). "Population, land-use and goldmining in Papua New Guinea." Yagl-Ambu 15 (2): 40-62.

Hughes, P. and M. Sullivan (1989). "Environmental Impact Assessment in Papua New Guinea: lessons for the wider Pacific region." Pacific Viewpoint 30(1): 34-55.

Hughes, P. and M. Sullivan (1992). The Environmental Effects of Mining and Petroleum Production in Papua New Guinea. Port Moresby, University of Papua New Guinea.

Hyndman, D. (1995) Ancestral Rainforests and the Mountain of Gold: Indigenous Peoples and Mining in New Guinea. Boulder, Colorado: Westview.

Iamo, W. (1999) "Governance and environmental laws in Papua New Guinea". Paper presented at the Fifth Mining and Petroleum Investment Conference, Sydney, 29-30 November 1999. 18pp, available on Conference CD from the Papua New Guinea Chamber of Mines and Petroleum, Port Moresby.

Imbun, B. and P. McGavin (eds) (2001) Mining in Papua New Guinea: Analysis and Policy Implications. Port Moresby: UPNG Press.

Jackson, R. (1982) Ok Tedi: Pot of Gold. Port Moresby: Word Publishing.

Jackson, R. (1983). "The poltergeist at the feast: distributional aspects of mining policy in Papua New Guinea." Unpublished paper presented at the Annual Conference of the Association of American Geographers, Denver.

Jackson, R. (1989). "Let them eat theory: is there any viable alternative to mining for the development of remote areas in Papua New Guinea." Unpublished paper presented at the Institute of Australian Geographers conference, Adelaide.

Jackson, R. (1991). "Not without influence: villages, mining companies, and government in Papua New Guinea", in J. Connell and R. Howitt (eds) Mining and Indigenous Peoples in Australasia. Sydney: Sydney University Press: 18-33.

Jackson, R. (1993). Cracked Pot or Copper-bottomed Investment? The Development of the Ok Tedi project 1982-1991, A Personal View. Townsville: Melanesian Studies Centre, James Cook University of North Queensland.

Jackson, R. (1994) "One Full Circle: BCL to PJV." Taim Lain 2(1): 18-26.

Jackson, R. and G. Banks (in prep.) In Search of the Serpents Skin: A History of the Porgera Gold Mine.

Jorgensen, D. (1997) "Who and what is a landowner? Mythology and marking the ground in a Papua New Guinea mining project." Anthropological Forum 7(4): 599-627.

Kirsch, S. (1989). "The Yonggom, the refugee camps along the border, and the impact of the Ok Tedi mine." Research in Melanesia 13: 30-61.

Kirsch, S. (1997). "Indigenous Response to Environmental Impact Along the Ok Tedi", in S. Toft (ed.) Compensation For Resource Development. Port Moresby, Canberra: Papua New Guinea Law Reform Commission and National Centre for Development Studies, The Australian National University: 125-136.

Kirsch, S. (in press) "Changing views of place and time along the Ok Tedi", in J. Weiner and A. Rumsey (eds.) Mining and Indigenous Lifeworlds in Australia and Papua New Guinea. Bathurst, Australia: Crawford House Publishing.

Manning, M. (2000) "Private Sector Perspective on the Reform Agenda and the 2001 Budget." Paper presented at the Sixth Mining and Petroleum Investment Conference, Sydney, 4-5 December 2000. Available on Conference CD from the Papua New Guinea Chamber of Mines and Petroleum, Port Moresby.

McGavin, P. A. (1993) Economic Security in Melanesia: Key Issues for Managing Contract Stability and Mineral Resources Development in Papua New Guinea, Solomon Islands and Vanuatu. Honolulu, Pacific Islands Development Programme, East-West Centre.

MMSD (2000) A Guide to MMSD. London: MMSD and International Institute for Environment and Development. 1 October 2000.

MMSD (2001) "Challenges and opportunities facing the minerals sector in its contribution to the transition to sustainable development (draft)". Memorandum, 11 February 2001.

Mineral Policy Institute (MPI) (1995). The Porgera File: Adding to Australia's legacy of destruction. Bondi Junction, Sydney: Mineral Policy Institute.

MPI (1999) Environmental Risks associated with Submarine Tailings Discharge in Astrolabe Bay, Madang Province, Papua New Guinea. Bondi Junction, Sydney: Mineral Policy Institute.

MPI (2000). Cyanide Crash: Report into the Tolukuma Gold Mine Spill of March 2000 in Papua New Guinea. Bondi Junction, Sydney: Mineral Policy Institute.

Natural Systems Research (NSR) (1996). Review of Effects on the Marine Environment: Misima Mine, Papua New Guinea. Report to Misima Mines Pty. Ltd. and Placer Pacific Ltd. Hawthorn Victoria: NSR. April

NSR (1997). Review of Submarine Tailing Disposal: Misima Mine, Papua New Guinea. Report to Misima Mines Pty. Ltd. and Placer Pacific Ltd. Hawthorn Victoria: NSR. April.

NSR (1999). Review of the Coral Reef and Nearshore Environment, Misima Mine, Papua New Guinea. Report to Misima Mines Pty. Ltd. and Placer Pacific Ltd. Hawthorn Victoria: NSR. October

Neale, T. (2001) "Sustainable Development in the mining industry: Some PNG examples" in G. Hancock (ed.) Proceedings, PNG Geology, Exploration and Mining Conference, 2001. Carlton, The Australasian Institute of Mining and Metallurgy: 205-206.

Nelson, H. (1976) Black, White and Gold: Goldmining in Papua New Guinea 1878-1930. Canberra, Australian National University Press.

Nurse, G. (1990) "The dynamics of changes in health status in the Ok Tedi impact area." Research in Melanesia 14: 1-21.

O'Faircheallaigh, C. (1982) Mining in the Papua New Guinea Economy 1880-1980. Port Moresby, UPNG Occasional Paper in Economic History, No.1.

O'Faircheallaigh, C. (1984) Mining and Development: Foreign-Financed Mines in Australia, Ireland, Papua New Guinea and Zambia. Beckenham: Croom Helm.

Papua New Guinea Chamber of Mines and Petroleum (2001) "Industry concerns with the new Mining and Petroleum taxation regime introduced in the 2001 Budget (following the taxation review)". Unpublished memorandum, May.

Papua New Guinea Department of Finance (1977) Financial Policies relating to Mining and Mining Tax Legislation: Statement of Intent. Waigani, Department of Finance, October.

Polier, N. (1994) "A view form the "Cyanide Room": politics and culture in a mining town in Papua New Guinea." Identities 1(1): 63-84.

Polier, N. (1996) "Of Mines and Min: Modernity and it's malcontents in Papua New Guinea." Ethnology 35(1): 1-16.

Power, T. (1999) Resource Industries Community Relations Manual. Port Moresby, PNG Chamber of Mines and Petroleum. (2 Vols).

Report of the Taxation Review (2000) Refining the Tax System. Port Moresby, October.

Rolpagarea, D. and T. Szwedzicki (2001) "PNG legislation related to mining projects" in G. Hancock (ed.) Proceedings, PNG Geology, Exploration and Mining Conference, 2001. Carlton, The Australasian Institute of Mining and Metallurgy: 217-222.

Standish, B. (2001) "Papua New Guinea in 1999-2000." Unpublished manuscript.

Tilton, J. et al (1986) Minerals and Mining Policy in Papua New Guinea, Port Moresby, Institute of National Affairs.

Toft, S. (ed.) (1997) Compensation for Resource Development in Papua New Guinea. Port Moresby, Canberra: Papua New Guinea Law Reform Commission and National Centre for Development Studies, The Australian National University.

West, R. (1992) Development Forum and Benefit Package: A Papua New Guinea Initiative, Port Moresby, Institute of National Affairs (Working Paper 16).

Appendix One: Terms of Reference

MMSD, Baseline Study and Gap Analysis for Papua New Guinea
May 2001

1. Purpose of Terms of Reference and the Baseline Study

These Terms of Reference are to guide the commissioning of a baseline study in Papua New Guinea (PNG), for the Mining, Minerals and Sustainable Development Project (MMSD) based in London.

The purpose of the baseline study is to identify the gaps in knowledge and understanding of the mining and minerals sector in PNG and the circumstances that have a bearing on the role of the sector in the society, economy and environment of the country.

The baseline study calls for a synthesis of current knowledge through a focus on several specific issues. In all cases however, it is essential that the study does not produce a simple record of the status quo. Instead, the baseline study should increase understanding of,

1. The main areas of contention and conflict including legacy issues

2. The structural and political constraints to progress in key areas

3. The key drivers of change in particular areas

4. Good practice in specific areas of activity

5. New initiatives which are being proposed and ones which are currently underway

Most importantly, the baseline study needs to include different stakeholder perspectives on each of these issues, either from published sources or from discussions with key actors.

It is intended that this baseline study will contribute to the MMSD final report.

2. PNG Baseline Study - Project Design

This activity will be commissioned with an external organisation /consultant(s). The work will be phased as follows;

PHASE 1 – May – Exchange Terms of Reference and Proposal

PHASE II - June to end-August, 2001. Overview, research and analysis of gaps in current knowledge including a brief interim report of progress on the baseline study.

PHASE III – Review and completion of a Final Report to MMSD London, due at the end of August 2001.

The MMSD baseline study in the PNG will comprise three parts

Part I:

A broad overview of current issues which are key to an understanding of the role of the mining, minerals and metals sector in PNG and which will include the following themes

1. A brief history of mining and minerals development

2. Economic considerations:

    - Markets for PNG's minerals and metals commodities
    - Profitability of the sector
    - Employment issues and potential

3. The current regulatory and policy framework and predicted future trends

4. The issue of access to land, permitting and land rights

5. Issues related to small-scale and artisanal mining

6. Community relationships, particularly in the areas of

    - social acceptability of mining,
    - cultural communities in transition in a mining area,
    - rehabilitation and clean up of mined out areas
    - community maintenance during and after closure

7. Environmental protection and degradation

8. Investment considerations

9. Governance issues and the development of a clearer understanding of existing and proposed mandatory and voluntary systems for making information available to actors participating in or affected by the mineral industries.

A scoping of the issues outlined above presumes the use of such secondary data, interviews and discussion with others as is necessary to address each area of interest.

Part II:

An overview of the potential mechanisms for creating broader participation of stakeholders in the dialogue process and in particular

1. A review of the opportunities for improved exchange of information on mining operations and their impacts amongst communities

2. Suggested approaches to improving dialogue and facilitating better and more effective multi-stakeholders discussions

Part III:

A description of the key areas where gaps in knowledge, practice, policy, communications and/or capacity, require more detailed analysis and stakeholder engagement.

An agenda and specific proposals for future progress in this sector.

3. Research Proposal For Baseline Study

The proposal should include at a minimum the following;

1. A brief outline of research objectives

2. A description of approaches and methodologies with reference to the research activities referred to in Parts I, II and III above

3. A timeline for the research including milestones and a deadline for final submission of the report.

4. An itemised budget including consultancy rates and person/hrs

5. An overview of the additional personnel needed to conduct this work

4. Expected Results

The baseline study will be presented in the form of a brief interim report to be submitted in mid-July and a final report due at the end of August. The work will be integrated into the final report of MMSD.

If additional funding can be identified, the report generated by this work will also be presented to a small workshop, which will be convened to review and revise the report.

Appendix Two: List of People and Organisations Consulted

Anderson, Greg, Executive Director, PNG Chamber of Mines and Petroleum
Bakani, Loi, Manager, Economics Department, Bank of Papua New Guinea
Brew, Ron, Manager, Corporate Affairs, Lihir Management Company
Bull, Vincent, Manager, BHP, PNG.
Hancock, Graeme, Department of Mining
Omundson, Tim, Environmental Manager, Placer Niugini
Taylor, Graham, Department of Mining
Temu, Ila, Placer Niugini
Togolo, Mel, Corporate Affairs, Placer Niugini
van den Brand, Evert, Manager, Placer Niugini