

PAPUA NEW GUINEA

By Anthony Williamson

Director - Mining Division, Department of Mining

Mining is an important feature of the PNG economy. Provisional compilation of the export earnings for 2001 indicates that export values were comparable to those for 2000, with mining accounting for 52% of all exports, the highest figure since 1992.

Total reported mineral production for the year 2001 was less than that for 2000. One major factor in the downturn was the closure of mining operations earlier in the year at Misima, and scheduled future pit preparation at the Porgera mine. PNG mines focussed on efficiency and cost-cutting exercises in 2001 to enhance revenues and production.

Basic Economic Statistics

	2000 (Kina)	2001 ^p (Kina)	2001 (US\$)
Export Values (million)	6,534.5	6,493.2	1,753.2
Gold	1,950.8	2,115.1	571.1
Copper+	1,316.9	1,259.3	340.0
Crude Oil	1,921.7	1,883.9	508.7
Others	1,345.1	1,234.9	333.4
Export Volumes			
Gold (t)*	74.54	69.1	
Copper (t)+	203.8	203.1	
Crude Oil ('000 bbl)*	23,629	21,294	
Export Prices			
Gold (per gram)	26.17	30.6	8.3
Copper (per tonne)	6,461.73	6,200.19	1,604.00
Crude Oil (per barrel)	81.33	88.47	23.89

^p provisional;

*includes Alluvial sources.

Source: * Bank of PNG;+ Dept of Mining.

The Ok Tedi mine has, on average, accounted for approximately 20% of the value of merchandise exports of PNG since it commenced operations in 1984. It contributes about 8.5% to GDP. The operator, Ok Tedi Mining Ltd (OTML) was owned 52% by BHP Billiton, 30% by the PNG Government and 18% by Inmet Mining Corp. of Canada during 2001. At the time of writing BHP Billiton had exited the project with the equity being transferred to an independently managed trust company. Benefit distribution from the Trust during the remaining estimated ten-year mine life will be one-ninth to the people of Western Province, two-ninths to the rest of PNG and two-thirds to a Long Term Fund (LTF).

The mine delivered higher grade ore to the mill than was budgeted for in 2001. The higher grade material was mainly skarn ores that required blending being generally more difficult to process than the usual monzonite feed.

Mineral Production

Mine	Au (kg) 2001	Au (kg) 2000	Ag (kg) 2001	Ag (kg) 2000	Cu ('000 t) 2001	Cu ('000 t) 2000
Ok Tedi	14,144	16,608	35,770	45,034	20,462	20,361
Porgera	23,658	28,318	3,516	3,707	-	-
Misima	5,182	6,880	20,318	24,199	-	-
Lihir	20,153	18,850	-	-	-	-
Tolukuma	2,216	2,025	9,090	5,470	-	-
Small Scale	1,689	1,859	674	787	-	-
Total	67,043	74,540	69,368	79,197	20,462	20,361

The average material mined per day for 2001 was 246,650 t and the corresponding average milling rate was 84,200 t/d. The grade of the 30.73 Mt of ore mined was 0.93% Cu and 0.81 g/t Au. Gold and copper recoveries in the mill were 71.4% and 56.2% respectively. These are not good recovery figures in comparison with similar operations elsewhere. Work is under way to enhance recoveries.

The Ok Tedi mine is now producing approximately 2,500 kg/mth of high grade gold concentrate (+0.5% Au), without affecting the overall grade of the usual concentrate product.

The latest Ok Tedi mineral resource and ore reserve calculation by OTML staff utilises the ultimate pit design, the geological block model and the June 30, 2001 equivalent cut-off grades.

Resource at June 30 2001

	Cu %	Au g/t	Mt
Measured	0.90	0.97	442.2
Indicated	0.56	0.65	173.5
Inferred	0.45	0.45	10.4
Total	0.79	0.87	626.1

Assuming the mine does not close prematurely, there are sufficient reserves for approximately another ten years production.

Reserve at June 30 2001

	Cu %	Au g/t	Mt
Proven	0.94	0.97	253.1
Probable	0.62	0.72	37.5
Total	0.90	0.94	290.6

The riverine waste disposal system employed at Ok Tedi has raised numerous environmental concerns. The key impacts of

riverine disposal are river aggradation, leading to overbank flooding causing forest dieback (currently 660 km²), an increased amount of suspended sediment resulting in loss of biomass, and a combination of the above leading to potential acid rock drainage problems. There are several mitigation measures either currently under implementation or consideration. One of the main environmental mitigation measures, and now a permanent feature, is the dredging operation at the Lower Ok Redi River (Bige). More than 68.5 Mt of river bed material have been removed since March 1998. Approximately 150 km² of re-growth is evident in areas of previous die-back along the river banks near the dredge slot.

The PNG Government passed legislation allowing the Ok Tedi mine to continue operating if the communities affected by the mine's operations give their consent. This consent came in the form of Mine Continuation Agreements that were signed by an overwhelming majority of villages.

Significant work took place throughout the year to clear the way for a BHP Billiton exit from the Ok Tedi operations. OTML will then be operated and managed as a 'stand alone' company. The new company will be operated under a new Constitution and the board will comprise six members, one from each shareholder, and three appointed as independent expert directors (with prescribed qualifications and experience) jointly by agreement of all three shareholders.

At the Porgera mine, Placer Dome has a 50% shareholding in the operation held through its wholly-owned subsidiaries Highlands Gold Ltd and Placer Niugini Ltd. Goldfields (RGC) Ltd holds 25%, Orogen Minerals holds 15%, Mineral Resources Enga 5% and Yuwai Ltd 5%.

The mine produced 23,658 kg (760,527 oz) of gold exceeding the forecast (21,321 kg) by 10.9%. Higher than budgeted pit material movement and mill-feed grade targets contributed to increased production.

Approximately 81.64 Mt was mined in 2001 from the Stages 3, 4 and 5 pits. This is 6.7% above budget estimates (76.48 Mt). Total material moved, including rehandle, was 89.69 Mt, which is 4.5% above the budget estimate of 85.81 Mt.

Stage 3 development was completed in the first week of October. Waste stripping in Stage 4 continued as per plan. Waste pre-strip continued in Stage 5 during the quarter in accordance with the budget plan. The mine has produced over 10.7 Moz since opening in 1990.

Based on a revised pit design, proved and probable ore reserves at the end of June, 2001, were estimated at 69.2 Mt at 3.1 g/t Au and containing 6.9 Moz of gold. In addition to the open-pit operations, it is anticipated that Porgera will return to underground mining early in 2002. Indeed, an underground feasibility study was completed late in the year and corporate approval has been given to re-commence underground mining.

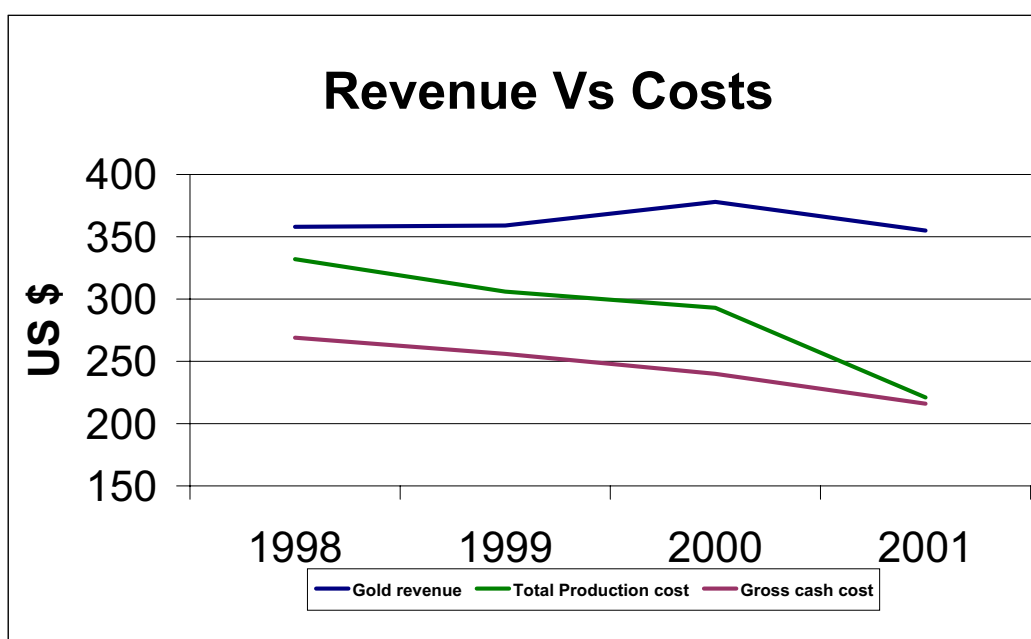
The recent announcement of a merger between Orogen Minerals and Oil Search will obviously result in a company focussed on the petroleum and energy sector. Orogen

presently has a 15% interest in Porgera which, although contributing positive operating cash flow, represents a relatively small component of the combined asset portfolio of the new merged company. Consistent with its focus on oil and gas operations, the merged company "will review the position of these assets in its portfolio".

The Lihir mine is held by a publicly listed company Lihir Gold Ltd, which in turn is held by Rio Tinto 16.3%, Mineral Resources Lihir 6.8%, Newmont 4.91%, and the remaining 67.2% held by institutions and the public. Lihir Management Co., a wholly owned Rio Tinto subsidiary operates the Lihir mine.

The mine continued to improve its productivity and increase its reserves and resources throughout 2001. Gold production was a record 647,942 oz (20,153 kg) exceeding forecast by 6.9%.

Future mining rates will benefit further from the increase in mechanical availability through the replacement of mobile support equipment. In order to achieve the material movement targets, an additional three Cat 785 haul trucks have been purchased. These are scheduled for January 2002 arrival.



Installation of the grinding circuit pebble-crusher is on target for commissioning in August 2002. To prepare for decreasing sulphur levels in the ore, heat exchange vessels have been designed and installed to capture the heat generated by each autoclave stack. The autoclave heat recovery circuit (two of three units) was commissioned successfully. The new autoclave heat recovery circuit, combined with lower sulphur grades, allowed the plant to operate unconstrained by oxygen capacity and heat balance requirements.

The mine is forecast to produce approximately 630,000 oz in 2002.

The measured, indicated and inferred mineral resources, inclusive of the reserves, are 354 Mt averaging 3.04 g/t Au for 34.6 Moz of contained gold. Included within this are proved and probable ore reserves of 121 Mt averaging 3.90 g/t Au for 15.1 Moz of contained gold.

Operations at Misima have, on average, produced over 300,000 oz of gold per year. The mine commenced operations in 1989 and has to date produced some 3.39 Moz of gold and 16.98 Moz of silver. The mine ceased operation in May 2001 although metal production is coming from the treatment of low-grade stockpiles which is anticipated to continue until 2004. Mill feed for the year averaged 1.01 g/t gold and 9.57 g/t silver. Metal production for 2001 was 166,603 oz (5,182 kg) gold and 653,224 oz (20,318 kg) silver.

Rehabilitation work focussed on the mined out areas and waste dumps. There are encouraging signs of decrease in sediment load in the creeks around the mining lease and re-vegetation is taking hold in the wall faces and dump slopes.

Tolukuma mine is owned and operated by Durban Roodeport Deeps Ltd (DRD) of South Africa. Access to the mine is by helicopter and all mine activities are helicopter supported. Gold and silver production from the mine

benefited from the purchase of new equipment earlier in the year, but is still hampered by low combined mechanical availability and corresponding low effective usage. Production in 2001 totalled 2,216 kg of gold and 9,090 kg of silver, an increase of approximately 10% over 2000 production. The mine has produced over 367,191 oz since start of production in 1995.

Approximately 7,500 t/mth of ore is mined from underground (Tolimi and Gulbadi veins) and about 3,000 t/mth from open pit (Tolimi vein). Recently, mined grades in the open pit have assayed around 14 g/t Au while those from underground average about 17 g/t Au. Mill feed averages 15.5 g/t Au and 114 g/t Ag. The ore is free milling and treated with a conventional CIL plant to give a gold recovery around 91%.

The mine life was initially estimated to be five years. However, exploration activities surrounding the known mineable reserves continue to be positive, and potential exists to extend the mine life by several years. Resources at the end of June 2001 were 1.38 Mt at an average grade of 28 g/t Au.

Exploration Activity

Mineral exploration expenditure in 2001 was focussed on advanced exploration projects with minimal expenditure on grass-roots exploration. Total mineral exploration expenditure was approximately US\$10 million, with most being spent on the Morobe Gold project, and on tenements around the Tolukuma mine.

Papua New Guinea has several advanced prospects, some of which are at an advanced stage of economic evaluation.

The Bougainville copper project commenced operations in 1972 and was producing at an annual rate of 166,000 t of copper and 450,000 oz of gold at the time of its forced closure in 1989. Over its operating life it produced 3 Mt of copper and 305 t (9.7 Moz) of gold in concentrate.

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

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

The Ramu project is a pre-development nickel and cobalt project located in Madang Province on the north coast of Papua New Guinea. The proposed project is based on the mining of lateritic ores at the Kurumbukari mine site and the processing of those ores at a refinery site located at Basamuk Bay some 130 km from the mine site. It is proposed to produce value added London Metal Exchange grade nickel cathode, a first for Papua New Guinea.

The project is designed to produce 33,000 t of nickel cathode and 3,200 t of cobalt cathode annually although the potential to expand the output by up to 50% from an operational base is well recognised. It is anticipated that the nickel will be produced for a cash cost of US\$0.41/lb net of cobalt credits (at US\$10/lb Co) or US\$1.38/lb Ni before cobalt credits. The capital cost of development is estimated at US\$838 million. Ramu is proposing a submarine tailings placement as opposed to placement of tailings in land-based tailings dams.

The completed feasibility is based on an ore reserve of 75.7 Mt at a grade of 0.91% Ni and 0.10% Co that will support the operation for at least 20 years. Potential has been recognised to extend the life through exploration success in the surrounding area.

The project has all the necessary government permits to proceed and agreements with the local indigenous communities have been reached. The project operator has been seeking additional equity participant(s) for

over 12 months to develop the project. Ramu is owned 68.5% by Highlands Pacific Ltd and 31.5% by Orogen Minerals Ltd.

The Morobe project is owned by Aurora Gold Ltd 50%, CDC Financial Services (Mauritius) Ltd (CDC) (45%), Kula Fund Ltd (5%). The Morobe gold project lies in the Wau area of Morobe Province. Wau is the site where the first large-scale mining of gold took place in Papua New Guinea in 1923. The project comprises three principal prospects, Hidden Valley, Kaveroi Creek, and Hamata. The measured, indicated and inferred resources estimated to September 30, 2000 are 79.1 Mt at 2.0 g/t Au and 28 g/t Ag.

Financial modelling of the project earlier in 2001, based on a A\$500/oz gold price, indicated that likely returns to the equity investors were inadequate, relative to their perceived risks for a project in PNG. Accordingly, the Aurora Board requested that further work be undertaken which should lead to enhanced shareholder returns and reduced risk. That work included:

- further drilling to increase the resource base with a view to deferring the substantial pre-strip commitments;
- review of infrastructure development costs;
- review and discussion with all relevant parties with a view to enhancing project returns and reducing project risks; and
- a full review of financial, operating and mining costs including, consideration of owner-miner/mining contractor and power supply options.

The above-mentioned review process proceeded in the field and office throughout the year. The consultation process mentioned in point three above, between relevant parties is not progressing being to Aurora's planned exit. The review process was scheduled for completion in April 2002.

Late in 2001 Aurora was the subject of a successful takeover offer resulting in board changes and a change in corporate strategy. Aurora and CDC have indicated they will be exiting the project after the completion of the study. The project will then be "up for sale".

The Frieda project is seeking to exploit a large porphyry copper deposit that was first discovered at Frieda River in the 1960s. Highlands Gold Ltd (now Highlands Pacific Ltd) took over the exploration licence in 1987 and embarked on an aggressive exploration and metallurgical testing programme to develop a mining project based on the Nena and Frieda deposits. The other partner in the project is the Japanese-owned OMRD Frieda Co. Ltd with 12.1%.

The total porphyry copper resource is estimated to be in excess of 1,000 Mt at 0.5% Cu and 0.3 g/t Au. The high sulphidation Nena resource, which lies adjacent to the porphyry system, has reserves of 52.8 Mt at 2.0% Cu and 0.7 g/t Au, with an additional oxide gold cap of 12.8 Mt averaging 1.4 g/t Au using a 0.25% Cu and 0.6 g/t Au cut off.

Recently, Highlands Pacific announced a five-year option agreement with Noranda that gives Noranda the option to acquire a 72% interest in the Frieda, April R and Bundi tenements.

Rio Tinto holds the exploration licences over an advanced exploration prospect at Wafi situated in Morobe Province near Lae. The prospect has two distinct mineral occurrences.

A porphyry copper prospect has been drilled out giving an indicated resource of 75.5 Mt at 1.22% Cu and 0.53 g/t Au, and an inferred resource of 24.7 Mt at 1.43% Cu and 0.96 g/t Au. Resource estimates for an epithermal gold prospect adjacent to the porphyry are given below.

Aurora Gold Ltd announced in March 2001, that it had entered into a Heads of Agreement to acquire Rio Tinto's interests in the Wafi copper/gold project and exploration tenements effective from January 1, 2001, subject to conditions. These conditions include PNG Government consents, and a decision by Aurora to proceed with development of the Morobe project. Aurora subsequently waived the Morobe development condition. Unfortunately, progress on exploration at Wafi has been marred by the above-mentioned takeover of Aurora Gold Ltd, and Aurora's planned exit from PNG. The fate of Wafi remains uncertain.

A mining lease application for an underground development has been submitted by Highlands Pacific over the Irumafimpa prospect within the Kainantu Goldfield of the Eastern Highlands Province. The application is presently being assessed by the Department of Mining and the Department of Environment.

Some interesting results have come from drilling undertaken last year. Assays reported from the completed drill holes include intersections of 5 m at 92.3 g/t Au, including 2 m at 227.7 g/t Au and 5 m at 12.7 g/t Au, including 2 m at 25.3 g/t Au.

Resource Estimates

Cut-off (g/t Au)	Zone A		North Zone		Link Zone		Total Au (Mozs)
	Mt	Grade (g/t Au)	Mt	Grade (g/t Au)	Mt	Grade (g/t Au)	
0.5	55.5	1.5	11.4	1.5	44.5	1.8	5.82
1	34.4	2.0	5.0	2.5	23.3	2.7	4.65
1.5	19.8	2.5	3.8	2.9	13.8	3.8	3.64
2	12.4	2.9	3.2	3.2	10.4	4.5	3.0
3	4.0	4.1	1.6	4.0	6.8	5.6	1.96

The current estimate of resources based on results to the end of December 2000, stands at 886,700 t at 28.3 g/t Au containing 805,600 oz of gold. However, recent exploration has discovered an extension of the Irumafimpa vein system.

The additional potential for resources has been identified in a landslip area, which uncovered near fresh rock on the northerly extension of the western portion of the vein system. Detailed channel and rock sampling outlined a zone of very high gold grades. Rock sampling results include:

- 1,466.0 g/t for a rock outcrop sample over a channel length of 0.25 m
- 100.3 g/t for a rock outcrop sample over a channel length of 1.0 m
- 680.0 g/t for a subsurface rock sample

- 306.5 g/t for a subsurface rock sample over a channel length of 1.1 m

An exploration adit was well advanced at 125 m from the portal. The adit will be used for close-spaced underground resource drilling and bulk sampling of the mineralisation.

Small Scale Alluvial Gold Mining

Small-scale alluvial gold miners produced almost 55,000 oz of gold in 2001. Reported production was down slightly from 2000, but this is believed to a problem related to data gathering and not a reflection of a downturn in production.

Production is primarily from hand method operations although there are a small number of mechanised operations now in production. An expanded extension service for small-scale miners commenced in 1998 and it is hoped that production from this sector will continue to increase over the next few years.