



Aerial photos taken in August 1983 of Panguna open-pit mine, associated facilities and Panguna township (top). Ship beeing loaded with copper concentrate, Loloho port facilities (below).



Marketing arrangements of copper concentrate producers: the case of Bougainville Copper Ltd

By Ciaran O'Faircheallaigh

This paper deals with the relationship between independent copper concentrate producers and the custom smelters which process and then dispose of, their output. Using as an example a major producer of concentrates, Bougainville Copper Limited, it provides details of smelter contracts, examines the distribution of metal revenues and seeks to explain variations in their distribution over time and between individual mines.

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Introduction

The pricing and marketing arrangements which govern disposal of mineral concentrates are of three principal types:¹

- First, mine output may be disposed of to another subsidiary within a vertically-integrated mining corporation, at prices and under conditions determined largely or solely by the parent company in accordance with its overall corporate strategy.
- Second, a mine may sell concentrates to unrelated consumers under long-term contracts based on prices negotiated between the two parties, as occurs frequently in the iron ore industry, for instance.
- Third, concentrates may be sold under contract to independent or custom smelters at prices based on prevailing quotations on 'free' metal markets, such as the London Metal Exchange; having processed the concentrates, the smelters dispose of finished metal to consumers. This method is widely used in the copper, lead, zinc and tin industries outside the United States.

In recent years, the significance of custom smelters in the world's base metal industries has increased substantially. For instance, between 1964 and 1974, the output of the major copper custom smelters quadrupled, against only a 70 per cent increase for primary capacity as a whole; in the latter year, they accounted for 29 per cent of 'free world' copper production.²

When a mine disposes of its output to a custom smelter, the proportion of the 'free market' price the mine actually receives is determined by the terms under which its concentrates are processed, terms which vary substantially over time and between individual companies. Smelter terms are of considerable importance both for mineral investors and relevant taxation authorities as they determine, in conjunction with production costs and metal prices, the total surplus available for distribution between the two.

Despite this fact, and despite the grow-

ing significance of custom smelters, relatively little has been written about the factors which determine the distribution of metal revenues between mine and smelter, or more generally about relations between the two, and much of what has been written is contained in limited-circulation trade publications. This article attempts to shed some light on these areas by examining relations between *Bougainville Copper Limited (BCL)*, a major producer of copper concentrates, and the Japanese, West German and Spanish smelters which purchase its output.

BCL's smelter contracts

BCL operates the Panguna copper/gold mine on Bougainville Island in the North Solomons Province of Papua New Guinea. Panguna was discovered and developed by *Conzinc Riotinto of Australia Limited (CRA)*, a subsidiary of the London-based *Rio Tinto-Zinc Corporation (RTZ)*, over the period 1964–1972. It is one of the world's largest single producers of copper concentrate, with average annual output of about 175 kt of copper in concentrates over the period 1972–1980. BCL's concentrates also yield substantial amounts of co-product gold and by-product silver.

BCL disposes of the bulk of its output under long-term sales contracts which were initially negotiated over the period 1967–69 with a group of Japanese smelters, *Norddeutsche Affinerie (NA)* of Germany, and *Rio Tinto Minera SA (RTM)* of Spain. The amounts originally contracted for are shown in Table 1. As that Table indicates, the contracts covered a fifteen-year period, with significant reductions in deliveries to Japanese and Spanish smelters scheduled after year ten. However, contractual tonnages were altered in 1977 and 1981, and only a slight reduction in deliveries (to the Japanese smelters) has in fact materialised.

Long-term smelter contracts offered BCL the prospect of secure and predictable markets for its concentrates, helping to reduce the uncertainty associated with

what was perceived as a high-risk investment. Guaranteed market access is of crucial importance in large-scale capital-intensive mining operations of the type planned by BCL; such operations have a very high ratio of fixed to variable costs, making it essential that constant operation at close to full capacity be maintained. Indeed the international banks which provided loan finance for the Panguna project made the granting of loans conditional on BCL entering into contracts of at least 10 years duration for disposal of the bulk of its output, and also insisted that BCL avoid dependence on a single national market for disposal of its concentrates.³ BCL was itself apparently convinced of the need for a conservative marketing strategy, as indicated by its signing of 15-year rather than the mandatory 10-year contracts. The greater degree of security derived from pursuit of such a strategy has not been without cost. For instance, concentrates now sold to NA could apparently be disposed of more profitably in South-East Asia.

The smelting companies hoped to obtain secure, long-term supplies of their principal raw materials, a crucial consideration in an industry where profitability depends on maintenance of a high and constant level of capacity utilization. In 1969, neither NA nor the Japanese smelters owned substantial copper mining capacity; RTM did possess some such capacity, but output was well below its concentrate requirements. In the absence of ownership ties, long-term contracts offered the best available means of ensuring security of supply. Thus the signing of long-term smelter contracts reflected the mutual desire of BCL and the smelting companies to reduce risk in an uncertain business environment.

As far as can be established, all trading between BCL and the smelting companies is on an 'arms length' basis. BCL does not have substantial corporate links with these companies (the only link is a minority RTZ holding in RTM), and sales are based on 'free market' prices. All contracts use

the London Metal Exchange price for copper, the London Gold Market price for gold and the London Silver Market price for silver, but different methods of calculating the relevant quotations are used by the Japanese and European smelters. Japanese purchases are based on average prices on the London markets in the month following the month of shipment. The European smelters can 'back-price' or make payment at prices which prevailed on a day of their choice during a defined payment period (usually 60 days). The normal procedure is that a smelter can, by notifying the mine before noon on a specific day, opt to price a part of a consignment on the basis of the previous day's quotation. However, limits exist on the tonnages which can be priced at any one day's quotation; typically, not more than 10 per cent of a shipment can be priced on any one day and not more than 25 per cent in any one week.

BCL's contracts follow standard smelter procedure in that a variety of factors in addition to quoted metal prices determine the amount it actually receives for its copper concentrate. Five are particularly important:

1. Smelting and refining charges

These usually consist of two elements:

a) a treatment charge, expressed in units of currency per tonne of concentrate. Treatment charges can vary substantially from mine to mine, for reasons discussed below.

b) a refining charge, expressed in units of currency per unit of payable copper.

Smelting and refining charges are fixed at the beginning of the contract period, but a majority of smelter contracts contain an escalation clause which allows for an increase in charges if the smelter's production costs (gauged by a standard agreed to by both parties) rise substantially, or if relevant exchange rates fluctuate significantly. Until 1979, all of BCL's contracts contained such a clause. In that year, the escalation clause was eliminated from the Japanese contracts; smelting charges are

now negotiated bi-annually with the Japanese, and provision is made for an increase in charges in each year. A similar arrangement was made with RTM in 1982 (Information provided by BCL).

2. Payable metal content

Under all smelter contracts, smelters pay for less metal than is contained in concentrates, and usually for less than they actually recover. Payable metal can vary from contract to contract, but generally speaking it depends on the level of metal contained in concentrate. Table 2 gives an indication of typical metal deductions used in calculating payable metal for copper, gold and silver.

BCL does not disclose information on payable metal contents. Its concentrates grade about 29 per cent copper, over 20 g/t (dry metric ton) gold and 70–80 g/t silver; thus it is presumably paid for the copper content of 96.7 per cent of concentrate sales and for 97–98 per cent of contained gold and 90 per cent of contained silver.

3. Penalty payment rates

These refer to sums which are added to smelting charges if the impurities contained in concentrates exceed certain 'tolerable' levels. Table 3 indicates standard tolerance levels for copper concentrate.

BCL has never incurred penalties because its concentrates are very low in impurities, but penalty payments can be extremely important for companies which produce lower-quality materials.

4. Price participation

Smelters are usually entitled to participate to a limited extent in revenues resulting from price rises above a certain level, which level is frequently indexed. For example, price participation might be 10 per cent above 90c per lb of copper; if the average price for a shipment was 100c per lb, then the smelter would receive 1c per lb of copper. Often contracts set a ceiling of, say, 5c maximum price participation.

BCL does not release details regarding the impact of price participation on reve-

Table 1**Bougainville Copper Limited's long-term sales contracts, 1972-87**

(tonnes of contained copper per annum)

	Japan	Germany	Spain	Total
Years 1-5	96 520	53 340	15 240	165 100
Years 6-10	81 283	53 340	15 240	149 863
Vendor's option	16 765	-	-	166 628
Years 11-15	30 481	53 340	6 096	89 917

Source:

Information provided by BCL.

Table 2**Typical metal deductions for copper concentrate**

essay

Copper	Deduction
20-26 %	0.8 unit ¹
26-32 %	1.0 unit
32-36 %	1.1 units
36-40 %	1.2 units
Gold (g/t ²)	Payable amount
1-10	90 %
10-20	95-96 %
over 20	97-98 %
Silver (g/t)	
under 30	nil
30-100	90 %
100-200	91-92 %
over 200	94 %

Notes:

¹ A unit deduction for copper refers to percentage points of dry weight of concentrate. If a concentrate contains 30 per cent copper, a one unit deduction means payment is made for 29 per cent, i.e. 96.7 per cent of the copper content.

² g/t = gram per dry metric ton.

Source:

Information provided by BCL.

Penalty elements in copper concentrate

Element	Tolerance level below which no penalty is applied in per cent
Arsenic	0.4 - 1.0
Antimony	0.2 - 1.0
Lead	2.0 - 7.0
Zinc	5.0 - 13.0
Bismuth	0.05 - 0.25
Nickel plus cobalt	0.5 - 2.3
Nickel	0.03
Cobalt	n a
Chlorine	0.5
Mercury	n a
Tin	n a
Fluorine	n a
Silica	n a
Tellurium	n a
Selenium	n a

Source:

P J Lewis and C G Streets, *An Analysis of Base-Metal Smelter Terms*, Institution of Mining and Metallurgy, London, 1978, p 3.

nues, but according to the Company that impact can be 'significant' at times of relatively high metal prices.

5. Delivery arrangements

Smelter contracts assign responsibility for payment of sea freight and insurance to one or other party, and this also affects mine revenue. For instance, BCL's Japanese contracts are on an fob basis, i.e. the smelters pay sea freight and insurance. The European contracts, on the other hand, are on a cif basis, i.e. BCL pays for freight and insurance.

Smelter contracts usually also contain provisions which affect revenue-sharing in more minor ways relating, for example, to payment of sales commissions to smelters, payment of insurance and sampling costs, and responsibility for any taxes, duties or tariffs incurred during shipment.

The distribution of metal revenues

The nature of contracts between concentrate producers and custom smelters can be explained by the fact that the smelters perform an essentially 'service' role, on the basis of their costs plus a mark-up.⁴ The mine bears all the risk: it suffers disproportionately at times of lower-than-average metal prices, and benefits disproportionately at times of higher-than-average prices. Smelters benefit from high prices through price participation, but only to a very limited extent. From this viewpoint, variations in smelter terms over time and between individual producers would be explained in terms of changing smelter costs and of differences in product quality (especially concentrate grade and levels of impurities). However, such variations can also reflect differences in the relative bargaining strengths of mine and smelter at a particular point in time, differences which can affect the extent to which smelter costs and product quality are actually reflected in smelter terms.

Relative bargaining strength is influenced by a variety of factors, the most important of which is the current state of

copper markets generally and concentrate markets in particular. In recent years, concentrate and metal markets have tended to move together, reflecting the impact on both of trends in mine production and metal consumption. However, it should be noted that particular market factors may affect concentrate and metal markets to varying degrees. A high proportion of world concentrate production is 'tied' to vertically-integrated companies; the quantity of concentrates entering international trade is small (about 1.1 million tonnes contained copper per annum), and the concentrate market may be influenced more strongly than metal markets by, for example, the opening or closure of a single smelter. In 1979/80, for instance, both metal and concentrate markets were buoyant. However, the coming on stream of copper smelters in South Korea and Taiwan in 1980 resulted in a further tightening of concentrate supplies, assisting some producers (including BCL) to substantially improve their contract terms.

Other factors influencing relative bargaining strengths are the importance of the individual mine as a source of concentrates and its reliability as a supplier, changes in smelter technology, currency movements and government regulations (for example pollution controls), and the extent of tariff or other protection enjoyed by smelters in their domestic markets.

Bargaining ploys or tactics also some times influence the distribution of metal revenues, as the following example indicates. In 1971/72 a major Irish concentrate producer negotiated contracts with seven European smelters. This company knew that one smelter, located in Spain, was desperately in need of concentrates. It first undertook bilateral negotiations with this smelter, and obtained extremely favourable terms. It then approached the other smelters individually, and demanded similar terms. However, they refused to negotiate bilaterally, joining together and appointing one of their number to

negotiate on behalf of all six, thus negating the mining company's 'divide and rule' tactics. Partly as a result, they were able to obtain terms considerably more favourable than those negotiated with the Spanish smelter.

Many smelting companies adopt a similar 'united front' approach. For instance, a single Japanese steel company (Nippon Steel) acts as negotiating agent for Japanese steel mills in their dealings with Australia's major iron ore producers, while the six Japanese smelters and two trading companies which purchase concentrates from BCL negotiate jointly with the Company.

Review and renegotiation of smelter contracts in the 1970s

When BCL negotiated its sales agreements, it assumed that the undertakings made by the smelters represented hard-and-fast, legally-binding commitments to purchase the tonnages nominated on the terms and over the periods specified. The sales contracts did include a 'fair play' clause which provided for their renegotiation if either partner were 'seriously disadvantaged' by changing circumstances.

But it would appear that neither party, and certainly not BCL, anticipated that this clause might have to be invoked in the near future, as indicated by the fact that in the Japanese contract it was not even included in the main sales contract but in a side letter.⁵ However, in the event smelter costs were violently upset in 1971-72 by a combination of new and stricter environmental controls, oil price increases, and currency disturbances. BCL's smelting charges were denominated in US dollars and after the 1971 devaluation of the US dollar the smelters reopened the contracts under the 'fair play' clause, seeking a significant increase in smelting charges in dollar terms.

This series of events came as a very unpleasant surprise to BCL. As mentioned above, the Company had expected smelter contracts to offer a measure of stability in an uncertain environment, but it

now faced a substantial increase in smelting costs before it had even commenced commercial production. However, because of the crucial role of the smelters in its marketing and financing arrangements, BCL felt it had little choice but to agree to their demands.⁶

Since 1972 BCL in common with other concentrate producers has accepted that rapid escalation in smelting costs (especially energy and pollution control costs), frequent changes in the supply/demand situation for copper concentrates, and instability of currency exchange rates dictate that smelter contracts be reviewed on a regular basis. A formal agreement was reached with the Japanese for bi-annual review of their contracts; until 1982 there was no formal provision for review of the European contracts (this is still so in NA's case), but in fact unscheduled renegotiations occurred every 18 months to two years between 1972 and 1980 (Information provided by BCL).

In general terms, it is apparent that the share of metal revenues accruing to copper concentrate producers has declined substantially since 1972. On the basis of a survey carried out in 1978, Lewis and Streets estimated that the per cent of the copper price paid to concentrate producers declined by 15 percentage points between 1973 and 1978, from a range of 80-90 per cent to 65-75 per cent.⁷ This decline is in large measure due to a substantial fall in the real copper price over this period. If the copper price drops and smelter charges remain the same, the mine's proportion of revenue declines. In money terms, smelter charges have risen substantially during recent years (by 135 per cent for 30 per cent copper concentrate according to one estimate⁸), reflecting the passing on of rising smelter costs to the mines, a process effected through cost escalation clauses or contract reviews. Given the essentially 'service' role of custom smelters, it is to be expected that cost increases should be passed on in this way. However, the extent to which this has actually occurred has been influenced

**The cover of BCL's 1982 Annual Report
Miners leaving work at the Panguna
mine.**

by the relative bargaining strength of mine and smelter at particular points in time. When buoyant concentrate markets have improved the bargaining position of mines, smelters have been forced to bear a part or all of cost increases. Indeed at times mines have been able to significantly *improve* smelter terms through contract reviews. For instance, a European concentrate producer informed the author that a review carried out in 1978 resulted in the mine receiving an additional 25 USD/t, at a time when it had been receiving about 300 USD/t. According to BCL, some of its contract reviews have led to changes 'of similar significance'. More generally, because of its position as a substantial and reliable supplier of high-quality concentrates, BCL may have fared somewhat better than concentrate producers as a whole.

The provisions of BCL's original smelter contracts have been departed from not only as regards the terms under which concentrates are treated but also as regards the volume of concentrate sales. In some years the Japanese smelters have failed to accept the full tonnages specified in contracts. In certain cases, deliveries have merely been deferred, with higher-contracted deliveries being made in later years. However, not all downward revisions have been initiated by the smelters; contracted deliveries for 1982 were revised downwards by 10 kt on BCL's initiative.

Failure by smelters to accept full contracted tonnages can create significant costs for BCL. It adds to uncertainty in a business environment which has become increasingly unstable since the Company commenced operations in 1972. BCL is relatively fortunate in that, as a producer of premium concentrates, it has always been able to find alternative markets; many other concentrate producers are less favourable than those offered by long-term contracts. Also, such sales involve additional costs to BCL arising, for example, from the need to identify and negotiate with potential customers and in



some cases to make new and separate shipping arrangements. On the other hand, it should be noted that in recent years BCL has at times found itself with unexpected shortfalls in production due to extremely variable ore grades, and in such cases it is clearly convenient for the Company to have some flexibility in contracted tonnages.

Thus the terms of BCL's smelter contracts have been subject to considerable change during the 1970s. Though contract reviews have at times favoured BCL, change has generally been detrimental to its interests. The Company has fought hard for its rights under smelter contracts, but has not attempted to prevent change by insisting on a rigid adherence to contracts terms. It feels that long-term smelter contracts still represent the most secure and stable method available of marketing its output, and indeed believes that its operations would be unviable without the custom smelters; consequently it must ensure their continued operation by bearing the brunt of adverse economic conditions in the smelting industry, despite the obvious inroads this makes into its profitability.⁹

Determination of metal prices

The discussion so far has concentrated on the distribution of metal revenues between mine and smelter. The *size* of reve-

nues available for distribution depends, of course, on the prices obtained for finished metal, in this case London metal market prices. Thus it is also important to examine the question of whether mines or smelters can deliberately *influence* metal prices so as to enhance their revenues.

Mines do of course influence prices in the longer term through their investment and production decisions, but what I wish to discuss here is the possibility of *market intervention* aimed at influencing prices. There is in fact little evidence that concentrate producers intervene in the copper market to any great extent, and indeed many (including BCL) have not, at least until recently, carried out any operations on the relevant exchanges. The situation as regards the smelters is more complex.

It is important to distinguish here between the ability of smelters to turn price fluctuations to their advantage and their ability to actually cause and control such fluctuations. It is clear that many European smelters do turn to advantage their proximity to, and intimate knowledge of, the London metal markets. As is the case with BCL's contracts, these smelters are usually allowed to 'back-price', i.e. make payment at prices which prevailed on a day of their choice during the contract period. Backpricing has been a traditional factor with copper purchasers by European fabricators, and smelters undertake such backpricing substantially on a back-to-back basis with declarations by their customers. The smelters apparently do form judgements as to trends in the copper market, and on the basis of these attempt to purchase as high a proportion as possible of concentrate deliveries on days of low metal prices. A major concentrate producer has estimated that this practice costs it an amount equivalent to 1-2 per cent of the value of sales, in comparison to a situation in which average metal prices over the payment period were applied.¹⁰ In BCL's case, this would amount to 3-9 million USD/year, depending on metal prices. The smelters are of course

constrained in the extent to which they can employ such practices by the limitations imposed by smelter contracts on the proportion of deliveries which can be priced on any one day.

The Japanese smelters apparently do not engage in these practices. Because they operate under a producer price rather than a free market system, back-pricing is not relevant. In any case, Japanese smelters are geographically remote from, and not very involved in, the London metal markets, which would make it difficult for them to operate the 'back-pricing' system to their advantage.¹¹

The ability of smelters to influence metal price movements is more problematical. It is unlikely that smelters would attempt to influence prices over the longer term. Substantial funds would be needed to finance market intervention on the scale required, with little guarantee of success. This point is illustrated by the experience of a number of Australian zinc and lead producers who attempted in 1975-76 to influence London Metal Exchange prices for these metals. They expended a total of 39.2 million AUD (43.5 million USD) in an attempt to support prices, but were ultimately unsuccessful; prices continued to decline, reflecting an unfavourable supply/demand situation for the metals concerned.¹² More generally, it is apparent that considerable risks are attached to any major attempt to influence metal prices by market intervention, as is clearly illustrated by the massive losses apparently incurred by Nelson Bunker-Hunt interests as a result of unsuccessful efforts to corner the silver market.¹³

However, in the shorter term smelters may be able to influence prices marginally so as to increase the advantage they derive from the back-pricing system, for instance by selling metal in order to depress LME prices on a specific day, their losses on such a transaction being more than compensated for by the purchase of a larger quantity of metal-in-concentrate on the basis of the lower quotation. Concen-

trate producers are certainly convinced that this does sometimes occur.¹⁴

Conclusion

A significant and growing proportion of world base metal concentrate production is disposed of to independent or custom smelters under contracts based on 'free market' metal prices. The distribution of metal revenues between mine and smelter is determined by a variety of provisions contained in smelter contracts and relating, for example, to smelting and refining charges, payable metal content, penalty payments, price participation and delivery arrangements. The nature of smelter contracts reflects the essentially 'service' role of custom smelters, and variations in the proportion of metal revenues accruing to mine and smelter can partly be explained by metal price changes and by variations in smelter costs, due either to differences in product quality or to price changes for smelter inputs. However, the distribution of metal revenues is also influenced by differences in the relative bargaining strength of mine and smelter, differences which reflect the prevailing state of concentrate markets and a range of other factors.

Both mines and smelters enter long-term contracts for similar reasons, particularly in the hope of reducing uncertainty and instability in their respective environments. However, during the 1970s, smelter contracts have become increasingly susceptible to frequent and substantial alteration, due to rapid increases in smelter costs, currency fluctuations, and frequent changes in copper concentrate markets. Consequently, their contribution to the maintenance of a stable operational environment has been reduced. However, concentrate producers continue to favour smelter contracts, because they believe that any alternative marketing strategy would create even greater uncertainty and instability.

In general terms, it appears that 'free market' metal prices are indeed free of

significant manipulation by either mines or smelters. For both, total metal revenues are largely a 'given'; their principal concern is with *distribution* of these revenues.

Notes:

¹ In addition to the three arrangements discussed here, concentrates may be sold on 'spot' markets; however, such sales normally absorb only a very small part of the output of most major concentrate producers.

² D N Waite, 'Copper', in C Payer (ed), *Commodity Trade of the Third World*, Macmillan, London, 1978, p 55; American Bureau of Metal Statistics, *Non-Ferrous Metal Data 1976*, New York, 1977, p 10.

³ Bougainville Copper Proprietary Limited, 'Credit Agreement, 28 July 1969', Unpublished, 5.2.(d).

⁴ Copper Studies, 1982-02-28., p 2.

⁵ Interview with BCL's Executive Manager, Commercial, Panguna, 1978-06-16.

⁶ Ibid.

⁷ J P Lewis and C G Streets, *An Analysis of Base-Metal Smelter Terms*, Institution of Mining and Metallurgy, London, 1978, Fig 2B, p 4, and p 6.

⁸ Derived from Ibid, Table 3, p 6.

⁹ Interview with BCL's Executive Manager, Marketing, Panguna 1981-06-24.

¹⁰ Confidential Source.

¹¹ It is important to remember that, despite the existence of modern communications systems, a close and permanent physical presence on the floor of the metal markets is still valuable in gauging, and quickly acting on, short-term market movements.

¹² *Far Eastern Economic Review*, 1977-07-15.

¹³ *Far Eastern Economic Review*, 1980-09-19.

¹⁴ Interview with BCL's treasurer, Panguna, 14 June, 1978; interview with Avoca Mines Limited Secretary, Avoca, Republic of Ireland, 1978-11-16. ■