

Politicized Ecology: Local Responses to Mining in Papua New Guinea

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ABSTRACT

Our paper draws on research in two sites where large goldmining projects are located — Misima and Lihir islands in Papua New Guinea. We examine the socio-economic context in which criticisms of environmental degradation arise. We discuss the social and political meanings embedded in local demands for compensation for environmental damage, drawing attention to the disparities between local Melanesian conceptions of the environment and global, Western ideas that inform international environmentalist criticisms of mining. We dispute the ‘romantic primitivism’ of some environmentalist discourse, using the work of ethno-ecologists and case studies of specific incidents on these islands, contesting the view that there is a natural conservationist ethic in Melanesia. The image of the ‘noble primitive ecologist’ that some environmentalists appeal to, would in most circumstances be rejected by Melanesians as racist and paternalistic, but is embraced as a strategy in conflicts with mining companies and when making legal claims for compensation. Alliances formed between landowners, environmentalists and western lawyers against mining companies such as BHP and Rio Tinto are based more on shared political ends than on the epistemological consistency of their perceptions of environmental damage from mining. Local Melanesian communities claim sovereignty over all resources and their compensation claims for environmental degradation constitute a new form of resource rent.

The debates about mining and its negative environmental impact that dominate critiques of mining projects in the developing world (see Mineral Policy Institute and Oxfam CAA websites) assume that environmental awareness will be the basis for international political solidarity in campaigns to improve the performance of large mining companies. In Papua New Guinea, the cases of Bougainville and Ok Tedi superficially support such a view. But a more ethnographically detailed examination of protests about environmental damage often reveals complex and contradictory political responses.

In a recent essay in *The Contemporary Pacific*, Glenn Banks (2002) challenged the view that Melanesian political responses to mining activities could be best understood as ‘popular ecological resistance’ (Hyndman 2000:40). He called for analysis of social conflicts surrounding mining projects in the Pacific to be undertaken within ‘a more robust and widely applicable framework’ (Banks 2002:40) that encompasses the social meanings of resources for the people who live there. In reviewing the more important recent anthologies on mining in the Australia-South Pacific region, Weiner (2001) also observes that:

... from an anthropological perspective, these studies leave largely unexamined and unanalyzed the nature of knowledge systems and the culturally distinctive epistemological and discursive processes *within* indigenous societies in these contexts. With but few exceptions, ... the absence of sophisticated understandings of indigenous motivations and cultural frameworks only seems to loom larger and more critical in the current period of extensive mining in indigenously populated areas. (Weiner 2001:1).

We extend Banks' and Weiner's scope to explore the political meanings embedded in local demands for compensation for environmental damage and to draw attention to the disparities between local conceptions of 'the environment' and the global, Western ideas that inform environmentalist criticisms of mining. This paper draws on observations and research conducted on Misima Island in Milne Bay Province in 1986 and 1993, and on the Lihir Group in New Ireland Province since 1995.¹ Both places are sites for gold mining by large multinational companies. The Misima mine is approaching closure; the Lihir mine is in its sixth, of a projected thirty-five years of operation. In both places the mining involves open pit extraction with deep-sea tailings disposal — a system that has been strongly criticized by some international environmental groups (Moody 2000; Burton 2000:7).²

The adverse environmental impact of mining in Papua New Guinea has generated major social disruption in several areas of Papua New Guinea where mining has taken place. On Bougainville, the site of the CRA/RTZ Panguna Copper mine, battles over benefits, compensation and environmental degradation eventually led to the abandonment of the mine by the company, claims for secession by some Bougainvilleans and a decade-long civil war. It has also occasioned litigation by, or on behalf of, affected communities that has been very expensive for the companies concerned. In 1996 BHP was forced to pay K150 million as compensation to communities of the Ok Tedi and Fly Rivers (see Banks and Ballard 1997). Recently in Los Angeles a case was brought against Rio Tinto on behalf of Bougainvillean people that claims billions of dollars in damages. The claim was made in terms of the alleged 'ecocide' (United States District Court, Central District of California, Western Division 2000:38; MPI 2000) and breaches of international human rights committed by RioTinto, and it lists 'destruction of an ecosystem' as one of the crimes (United States District Court, Central District of California, Western Division 2000, section H, 36).

EQUILIBRIUM ECOLOGY AND ROMANTIC PRIMITIVISM

This raises a problem of terminology: the difference between what has been called 'ecocide', and *any* human intervention that disrupts, reduces biodiversity or irreversibly transforms a specific ecological system is not clear. More importantly the claim is constructed in terms of a popular view of the 'natural equilibrium' in ecological systems, which assumes climactic homeostasis and that the only destructive forces to that balance come from human interventions. The political constructions of 'the environment' that inform most environmentalist critiques and lawsuits draw on outdated notions of ecological science that ignore 'non-equilibrium dynamics, spatial and temporal variation, complexity and uncertainty...' (Scoones 1999:479; van Helden 2001:46). While it would be wrong to lump some of the worst forms of mine-related destruction (such as sedimentation of rivers and high levels of heavy metal pollution) observed in and downstream of Panguna with the kinds of natural disturbances that in fact *are responsible for* the high biological diversity of rainforests and coral reefs, it is nevertheless important to note the divergence of this equilibrium-oriented thinking from contemporary ecological theory (May 1973; Connell 1978; Krebs 1994:537–539, 572–600). Moreover the 'pristine rainforests' that are championed by environmentalists in these contexts are often profoundly modified by millennia of humanization (Clarke and Thaman 1997, Bayliss-Smith *et al.* 2003).

The environmentalist critiques also incorporate classic 'romantic primitivist' notions about the lack of any degrading ecological transformations brought about by indigenous inhabitants. The local inhabitants are perceived as benign 'natural' elements; the industrial interventions are depicted as destructive and malign. While these representations draw on dualist models of Nature vs. Culture they place industrial man in the cultural domain and local Papua New Guineans firmly in the natural world, along with plants and animals. A popular travel book by Jacques Cousteau (which has been cited in the Complaint laid by Bougainvilleans in Los Angeles) illustrates this type of construction: 'These are people who have had only the vaguest contact with the modern world. There are tracts of rain forest still unsurveyed by terrestrial biologists, and seas that remain largely unknown to marine science. Moreover, these natural habitats are thought to be among the richest and most diverse remaining on the planet.' (United States District Court, Central District of California, Western Division 2000, 2).

The evocation of a pristine wilderness thinly populated by innocent primitive people who are duped into consenting to mining agreements is a rhetorical device that is embraced by people who have little familiarity with Papua New Guinea. It seriously misrepresents the complexity of the situation confronting communities and mining companies during the lengthy negotiations that precede any mining agreement. Papua New Guinea is an autonomous nation-state with a democratically elected parliament, and a Mining Act that must be adhered to when mining leases are determined. Local landowners are well aware of their rights over land and highly litigious when they are aggrieved. They are also prepared to adopt this primitivist image, which in other contexts they would reject as racist and paternalistic, when it is a means to winning a lawsuit. Bougainvillean secessionists arguing for self-government stress their familiarity with 'the modern world', its institutions and its technologies. Many believe that they could reopen Panguna and operate it entirely with Bougainvillean expertise and labour. They would be affronted if they were accused of not having 'the vaguest contact' with modernity.

The lawsuits they have brought in the cases of Ok Tedi and Bougainville have been based on local discontent drawing partly on the experience of impact, and partly on scientific analysis of the effects of mining operations on rivers and terrestrial resources. It is often assumed that these two views of adverse impact coincide — the one being the Western scientific representation of the other, experiential knowledge of impact.

The convergence is *post hoc* and based on shared political ends rather than epistemological consistency. The scientific representation of environmental impact and its comprehension by the people whom it affects come together in the aftermath of degradation and in the context of legal claims. It is then that local Papua New Guineans are inclined to listen to, and incorporate into their worldview, those scientific explanations of processes that have affected their environment and, in some instances, now threaten their livelihoods. This enlistment of scientific authority is not surprising — it also occurs in Europe, North America and Australia. People 'don't know what they've got till it's gone' and the prescient minority who provide early warnings are treated as unrealistic pessimists until the loss has occurred. Only then are they recognized as the prophets of the doom that has befallen the land, rivers and seas.

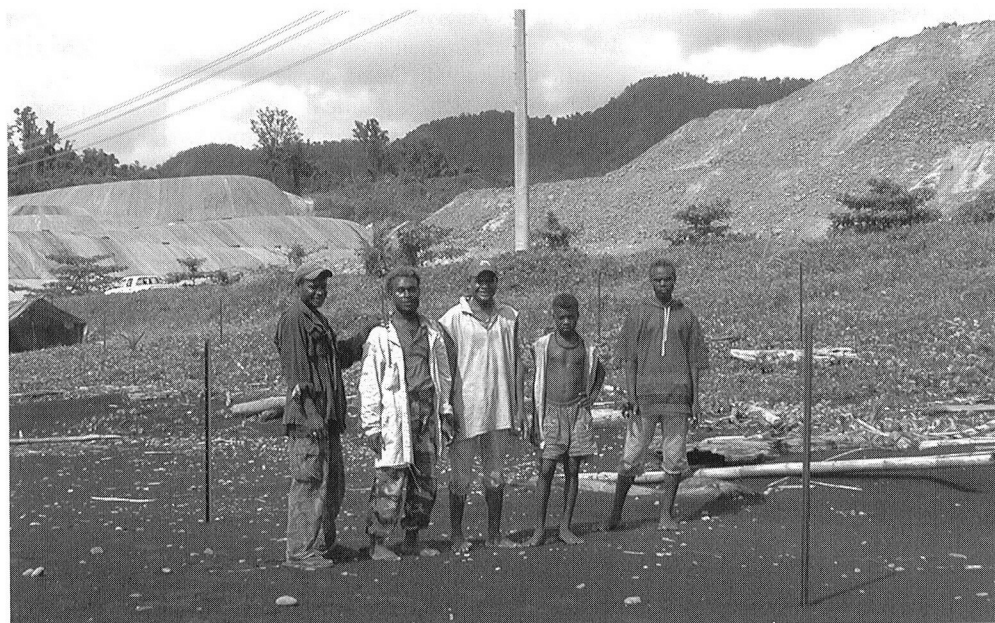
There are individual Papua New Guineans who are committed environmentalists. In most places that we have worked we have encountered villagers with little education who are profoundly disturbed by the impacts of mining, commercial fishing and logging and oppose these activities on environmental grounds. There are also a growing number of educated people in the country who are committed environmentalists, and often work for Non-Government Organizations (NGOs) on conservation, sustainable development and community educational projects. A number also work for the government. Yet they have little effect on the decisions made when contractual arrangements for mining leases are negotiated or compensation payments calculated. Even though people in the Ok Tedi region are

demanding compensation for the devastation caused by sedimentation of parts of the river, neither they nor the government of Papua New Guinea want mining to cease; as in different ways, both parties perceive the economic benefits to be paramount. The desire for development and wealth dominates discussions and the emphasis is on the extraction of benefits for local people, financial compensation for loss of land and resources, and improvements of infrastructure and services. Even now, on Lihir, the outrage about environmental impact on the island of some villagers does not convert to opposition to further mining.

The Mining Act commits companies to undertake continued exploration and in the course of this, they are required to negotiate terms of access to land with the local customary owners. While landowners bargain hard, they do not demand stricter controls over the environmental effects they observe elsewhere on the island, rather they ask for more money, more goods and other accoutrements of modernization. It is in fact the companies that seek to improve their performance in protecting the environment, partly as a way of avoiding escalating claims for compensation, and partly to avoid external criticism.

Thus, when a leatherback turtle (*Dermochelys coriacea*) came up to lay eggs on the beach that fringes the mine area on Lihir in 1996, the environment department was alerted because local Lihirians were attempting to move it to a village for butchering, with a front-end loader. Martha Macintyre worked with the environmental officers from the company and the government Department of Conservation to develop an educational campaign to discourage people from killing turtles and collecting their eggs. Meetings in villages and schools, posters and information pamphlets in Tok Pisin and Lihirian all explained the concept of an 'endangered species' and reasons why people should no longer eat leatherbacks or their eggs. This had no effect, and each year the mining company employs young boys to guard the nesting ground from predation for the duration of the nesting season.

In the interviews conducted at this time, we asked if old people could name animals that had formerly been plentiful but were now depleted or vanished. Several people recalled that until the 1950s wallabies (*Thylogale browni*) had been plentiful, but that after World War II, when people acquired shotguns, they were hunted to extinction. When we asked if



Turtlewatch team.

they regretted this, all men replied that they were sorry because wallabies were so good to eat. Biodiversity has no intrinsic value, and extinction is not perceived as regrettable in itself.

It is in this context that mining companies begin negotiations and supply host communities and landowners with information about environmental impacts. The concerns of the local people at this juncture are almost invariably directed towards loss of utilisable resources and amenity. Environmental preservation *per se* is not the priority of landowners. This is not to say that even in the early stages of mining negotiations the companies ignore environmental effects or local discontents. But their attention is driven by external, international pressures from environmentalists based in the industrialized nations rather than the demands of local people. The amount of money spent on environmental baseline studies, feasibility studies, the design of extractive processes and waste disposal methods that minimize degradation, and the regular monitoring of environmental impact are testimony to the ways that international corporations now see environmental matters. Attention to minimizing impact is a major factor in attracting investors and adverse publicity has adverse financial effects on investment, insurance and perhaps even on marketability.

Company interest in environmental impact is managed through scientific analyses rather than the subjective experiences of local inhabitants. The criteria are scientifically constituted and the processes aim to limit levels of toxic compounds such as cyanide, biologically available forms of heavy metals, and significant deviations from normal of salinity, temperature and pH. When environmentalists criticize a project, the companies respond by producing wads of reports and monitoring data, which typically demonstrate compliance with international standards on toxic emissions, such as those of ANZEC (Australian and New Zealand Environmental Council), or the London Convention. 'Snowing' the opposition with scientific data is a common tactic employed by mining companies. Of course it has little effect on most environmentalists, who discount the work of independent scientists who are engaged by the mining company, as at best partial if not deliberately distorted.

The habit of commissioning scientific investigations and proffering data to refute or placate critics or validate a legal defence has been adopted in response to local criticisms, with even less effect. The vast majority of people in Papua New Guinea do not hold science in any special esteem. Even when scientific explanations are translated into Tok Pisin or the local language, the concepts on which they draw are generally unknown and inaccessible. Melanesian understandings of their natural environment are derived from other cultural traditions and they expect different responses to complaints about mining impact from those of Western environmentalists. (Filer 1998; Van Helden 1998; 2001; Ellis 1997).

RETHINKING ETHNOECOLOGY

Ecological anthropology has a long and distinguished history in Papua New Guinea. It has also been influential in creating some of the commonly held views of the relationship between people and their natural environment. Popular natural history and tourist publicity reinforces Western preconceptions about Papua New Guinea as a land that is a 'paradise' where people live in primeval harmony with superabundant Nature (see Lutz and Collins 1993; Hyndman 2000). The works of anthropologists such as Roy Rappaport (1968, 1971), or the popular writing of natural historian Tim Flannery (1998) and numerous others have in a variety of ways contributed to the misconception of Melanesians as 'natural stewards of their environment' and 'traditional conservationists.' These claims pervade populist environmentalist constructions of people in Papua New Guinea whose natural resources are affected by mining. This is not because such writers represented the people with whom they worked as having a conservationist ethic or aesthetic — but rather because an idealized, functionalist depiction of the relationship between people, place and resources is fundamental to Western environmentalist thought. People already committed to the ideal of conserva-

tion read and absorb those elements that substantiate their views of a desirable ecological balance between humans and their environment. Subsistence agriculturalists and hunter-gatherers are archetypes for a romantic environmentalism, especially when they inhabit a part of the world where land is plentiful and populations small. The ideal of ecological equilibrium is discerned in the cyclical use of resources and the provision for regeneration. Thus WWF can claim, 'Indigenous peoples and conservation organizations should be natural allies...' (*Indigenous Peoples and Conservation: WWF Statement of Principles*, 1996).

Most of the anthropologists whose research concentrated on ecological relationships noted the lack of a conservation ethic in Papua New Guinean cultures (see Morauta, Pernetta and Heaney 1982). While some, such as Rappaport and Flannery argued that rituals or customary techniques could have a latent conservational function, most interpret such effects as accidental, unwitting or fortuitous. Bulmer, in a brilliant and prophetic essay written over 20 years ago, observed that many of the apparent conservational practices were 'not consistent with a modern, scientific-materialist approach' and that 'the explicit objectives of traditional religious practice were not the preservation of wild vegetation and wildlife, but the social and physical welfare of human beings.' (1982:68) He maintained that traditional ideas about natural resources were in fact antithetical to Western ideas of conservation.

Lihirians, like other Melanesian people, value their land, its fertility and endow specific places with sacred or historical significance. The large outcrop of rock, called Alaia, that looms over Luise Harbour has been preserved within the mining lease because of its cultural status as the entrance to the 'place of the dead' in ancestral times. There are trees and reefs that are sacred because of the custom of depositing the teeth of old people there. Possibly because of the experience of mining in Australia where legislation relating to sacred sites has such salience, the identification of places of cultural significance was carried out long before construction began. Lihirian cultural traditions emphasise the ancestral *use* of places rather than natural features. Thus burial grounds and sites of men's houses long abandoned to bush are more likely to be deemed sacred. Within the mining lease area there were relatively few such sites — perhaps because it was a thermal area and so unsuitable as a village site. But caves, large rock formations and places where spirits (TP *masalai*) live retain their significance and Lihirians continue to make offerings of ferns and other gifts before traversing or entering such places.

As in other Melanesian cultures, Lihirian understandings of their environment were formerly most commonly enunciated in terms of a complex cosmology that included flora, fauna, topographical features, supernatural beings, ancestral spirits and other beings who inhabited the island. Over the past nine years, the pervasive idea of 'the environment' has been shaped by local understandings of the impact of the mine on marine resources and terrestrial flora and fauna, including domesticated plants. These incorporate popular representations of environmentalist discourses so that people refer to environmental destruction (usually using English words) in terms of 'pollution', 'acid rain', 'cyanide poisoning' and 'loss of biodiversity'. Both the more 'traditional' understandings and the newly incorporated environmentalist languages are now often set in a Christian context that is dualistic and in many respects contradictory. Thus, in a meeting outlining political strategies for development a Lihirian political leader pronounced (in English) that Lihirians must use 'God's garden' 'based on the fact that nature provides for all living things' and that 'Man is infinitely superior than all of the animal kingdom. Man is the only species with the ability to think and choose what he wants.'

The lack of a conservation ethic can itself be explained in functionalist terms— they did not need one and therefore did not develop ideas about sustainability. The low populations and simple technologies ensured that human impact was restricted. Bulmer and, more recently, Flip van Helden (1998) have both written extensively about the way that ideas of attachment to land and resources, cultural identity and territoriality are more often expressed in terms of ancestral clearing and 'domestication' of the forest than in terms of a

'natural affinity' between people and the untamed forests around them. Similarly, work on Tubetube in Milne Bay Province suggests that those communities whose economic stability depended on marine resources and sea trade routes did not perceive their environment as benign or its resources in need of husbanding. Rather, while the sea was conceptualized as a superabundant resource — it was inhabited by myriad beings (fish, turtles, flying 'witches', man-eating spirit creatures) that were elusive, capricious, usually dangerous and often hostile to humans. No primeval symbiosis was imagined in myth, nor did practical knowledge guarantee success as a sailor or fisherman — although magic could do wonders. The sea was full of hazards, human management of its dangers and plunder of its resources a matter of pride. Anthropocentrism may be expressed differently, but it is not unique to Western industrialized societies (Macintyre 1983).

Environmentalist NGOs have different priorities and fears about the impact of mining on Lihir and Misima than those of the people who live there. Both mines use Deep Sea Tailings Disposal — so that the tailings, with their various heavy metals, are discharged at considerable depth³ and are deposited on the seabed. In both places the ocean is very deep, dropping away sharply from the coastline. Given the small areas of each island, their location on the 'Ring of Fire' and the dangers of storing toxic wastes on a relatively densely populated island, DSTD was considered the safest option. Environmentalists oppose this method, which they believe allows tailings to affect biota that live on the sea floor and so enables the toxic, heavy metals to move up the food chain. The long-term impacts of DSTD are not known, but the dangers that tailings pose for marine life in the upper, photic zone and riverine environments is — and so the choices that they present for mining companies are: 1. Don't mine using methods that produce tailings that are harmful to the environment. 2. Devise safe disposal systems. Either way, in communities where 'mining' and 'pollution' are perceived to be sources of income and 'development', local people would welcome neither strategy. Similarly, given the parlous state of the PNG economy, the government has no incentive to require mining companies to work in ways that are more cautious environmentally. The processes required would probably increase production costs, reduce profits and perhaps make PNG a less attractive place for large companies to operate.

MISIMA AND LIHIR: SOCIOECONOMIC IMPACTS

Misima and Lihir are both relatively small, volcanic islands. Each in its own way conforms to the European fantasy of the tropical island. When the mining began on Misima in 1987, the population was less than 7000. On Lihir, at the time of commencement in 1995, it was about 6000. Although there had been no fewer than 16 mining operations on Misima over the previous century, and parts of the island were given over to large coconut and cocoa plantations, the impression of a community of subsistence agriculturalists was easy to sustain. Cash cropping had waxed and waned with copra prices, and Misimans had consistently failed in their various attempts to set up a viable fishing industry. Similarly on Lihir, the senile coconut plantations and abandoned cocoa fermentaries were the only sign that people had once embraced cash cropping as a means of 'development'.

On both islands people lived mainly on food from their gardens and money remitted by their main 'export' — the educated islanders who had found employment in towns elsewhere in the country. The majority of people lived in houses made from bush materials; there were no sealed roads on the islands; the predations of small-scale logging that had removed the ebony stands in the Misiman forest were invisible in the regrowth of a decade. Here and there, signs of its industrial past — large stone crushing machines, a railway line, a tunnel blasted through a huge rock near the coast — were barely visible through the tangled vines. Lush green jungle hid the scars that mining had inflicted. On Lihir a crumbling concrete ford across a stream was the only remnant of a Malaysian logging project. The mountain slopes that had been stripped were covered in bush and vines.

What did people want from the mining projects? Sealed roads, profitable businesses, new schools, health services, reticulated water supplies, electrification, trucks, beer, modern clothes and a way of life that did not involve constant toiling in their gardens. Everyone wanted 'permanent houses' — houses made of milled timber with iron roofs. Men in particular wanted to be wage-earners and businessmen rather than gardeners. The development aspirations of Lihirians or Misimans at the times of negotiations over mining leases often override consideration of the period after mine closure. In the case of Lihir, the negotiators concentrated on continuities of cash income, through trust funds for their descendants, rather than strategies for alternate sources of income that involved utilization of other resources.

Their dreams of development did not involve the conservation of the natural environment. On both islands, in the early phases of the projects, one of the most prestigious items that men could acquire (after a motorboat and a truck) was a chainsaw. On Misima some young men felled a three-hundred-year-old tree in pursuit of a cuscus (a small marsupial) — an act of destruction aimed more at dramatically displaying their mastery of their new machine than anything else. On Lihir and Misima the piles of non-biodegradable rubbish (plastic bags, beer bottles and cans, old batteries, abandoned vehicles) that collect on the edges of villages and on beaches do not occasion much concern; certainly not enough to inspire communities to clean them up.

In both places the mining companies were committed to privileging local people in employment and this policy meant that the educated 'expatriate islanders' flooded back to the islands, eager to enjoy the benefits of development and to escape the towns on the mainland where costly housing, crime and inadequate services prevail. The population of Misima doubled over a ten-year period, while on Lihir it took only five years for it to reach 12,000. On both islands there was also an influx of migrants from neighbouring islands as well as enterprising Sepiks and Highlanders who came as employees for contractors, small-scale entrepreneurs or simply in the hope of finding work.

The burgeoning populations of the islands have had a pronounced and visible impact on the terrestrial environment of both islands. In both places the flow of money from compensation, wages and other benefits generated an efflorescence of competitive feasting associated, in terms of local tradition, with gaining land and political power. Large areas of land were cleared, including areas that were heavily wooded, steep slopes, so that leaching and erosion has become a major problem on Misima and threatens to do so on Lihir. While the population growth is an indirect effect of the mining company's presence, the environmental impact of migration is due to the lack of any local practices that measure, monitor or constrain environmental degradation from their subsistence techniques.

The assignment of responsibility for action that might temper or regulate such impacts is extremely complex. At a meeting of stakeholders on mining and the environment held in Sydney Australia in 2000 by Placer Dome Asia Pacific, one environmentalist critic suggested that the mining company should be 'made responsible' for the population growth on Misima and Lihir and develop appropriate responses to inhibit dramatic explosions in population. It is extremely difficult to think of responses that could inhibit population expansion that would not breach human rights; any mining company that attempted to impose policies would be assuming the role of the State. Restrictions on movements within a country are breaches of citizens' rights (which in PNG are enshrined in the Constitution). While there is general hostility towards migrants on Lihir, this does not translate into local government strategies aimed at inhibiting their influx. In fact, as migrants are prepared to pay rent, individual Lihirians are often quite willing to have them come and so provide another source of income that requires no labour.

We believe that campaigns encouraging family planning as a means of reducing the birthrate should not be the province of private companies. Not only would this assume the responsibilities of the State, but in a predominately Catholic community such as Lihir, it

would be interpreted as an attempt by the mining company to limit the population in its own interests and as an encouragement to commit sin. Besides, the Health Department in Papua New Guinea already has a comprehensive policy on maternal health and family planning. Insistence by outside groups that mining companies should take responsibility for all changes that occur in the course of a project actually reinforce project dependency and erode national autonomy.

VILLAGERS' CLAIMS FOR ENVIRONMENTAL DESTRUCTION

"It is easier to make people realize the possible environmental destructiveness of the actions of external groups than to persuade them of the dangers inherent in their own." (Bulmer 1982:72)

In the current economic climate of PNG one might add that it is almost impossible to convince people who long for the material benefits of logging or mining, that the direct and indirect damage to their environment might outweigh all the short-term benefits of compensation and employment. In addition to that, the fact that environmental damage can become a source of regular income (in the form of payments for dust pollution, water discoloration, etc.) means that it can even be seen as beneficial to those most affected.

On Misima, as the mine approaches closure, people have begun to take stock of the long-term effects and to worry about the loss of income as well as the problems of alternative income-generation. In the early phase of the mine the company's business development section attempted to assist a range of cash-cropping ventures. Most people were not interested as they associated these activities with being 'backward' and rural. More than one million dollars was spent to encourage a fisheries project, but as with so many such ventures tried in Milne Bay Province, this has foundered. During the last ten years, as large tracts of land have been cleared and fallows have shrunk (from around ten years to less than three years in the worst affected areas) people have observed that plants grow less well and crop yields have declined. Over the same period, they have been paid for environmental damage and are familiar with the large compensation payments that have been paid to people in the Ok Tedi region for the degradation of their environment. All of these elements must be seen as contributing to the heavily politicized claims for environmental degradation. 'Compensation' is seen as 'easy money'.

The claims are for both direct and indirect degradation. Misimans, unlike (most) Lihirians, appear to be aware that the problems of soil fertility and low yields are due to over-cropping and reduced fallow. The destruction of large fruit and nut trees to build houses and make gardens is now recognized as reducing food resources, especially in the months before the annual yam harvest, which is regularly the time of 'famine'. The islanders remain conservative about agricultural techniques and resistant to modifications such as artificial fertilizers or manures. Their claims on the company are based on a view of indirect responsibility — they maintain (no doubt correctly) that if it had not been for the mine, 'expatriate' Misimans would not have returned and the land pressures would not have developed.

This attribution of blame to a single factor, the mine, has emerged as awareness that the 'money is drying up' increases. Certainly in 1986, when Rolf Gerritsen and Martha Macintyre undertook the Social and Economic Assessment research, many men and women indicated that land shortages and soil infertility were looming problems — and they related them to population increase. People are caught up in processes of rapid social and economic change that are difficult to control; land use being but one. But they are not devoid of agency. Nor are they incapable of recognizing that most transformations are the consequences of myriad individual choices. Insistence that the mining operation is the sole determinant of change is a political tactic that unites people and enables them to demand compensation. The reluctance to assume any responsibility for land degradation is obvi-

ously strategic, as are other claims, such as the Giant African Snail (GAS) (*Achatina fulica*) infestation.

In a recent report on the Misiman responses to mine closure, Julia Byford reported:

The introduction of the African snail is a grave concern to the Misiman community as this pest has the potential to dramatically affect local food production which many people rely on for survival and more people will after the mine closes. This voracious eater has yet to infect the whole island, but is making steady progress. MML has never accepted liability for their introduction but has tried, unsuccessfully, to eradicate the snail using baits. They came with the mine but they [MML] still keep denying this. These snails are a really big problem and do a lot of damage to our crops. They are now as far as Ewena [at the western end of the island]. You can kill them but they lay thousands of eggs and keep on increasing in numbers. (Byford 2001).

Yet in 1986 when we first worked on Misima we observed hundreds of Giant African Snails on the grass in front of the guesthouse at Bwagaoia. They are epidemic in many parts of Papua New Guinea and very difficult to eradicate (Mead 1973; Department of Agriculture and Livestock 1993). People know of their depredations and that there are measures that can be taken to control outbreaks. They have appeared also on Lihir since the mine began — brought in by villagers on two separate occasions, on timber and on vegetables. There the infestation has been reasonably well contained, mainly because the environment department of the mining company acted quickly, burning breaks and collecting and destroying snails and eggs, and locals have continued to use these methods to try to limit the spread of the snails. Although local people recognized that blame for their presence could not be attributed solely to the company, they took the same line of argument as Misimans over land pressure — if the mine had not been there local people would not have the money to be importing timber or vegetables.⁴ By insisting that all negative effects are the responsibility of the mining company, people not only make a case for compensation, but abdicate political authority over the management of change. This may also be related to the fact that people have no faith in the capacity or willingness of the government to manage such issues and so do not object to the mining company taking the role of de facto government in many contexts.

There are increasing complaints about environmental damage and demands for compensation on Lihir. These are determined by numerous factors, but at present the primary one appears to be economic — the decline in garden yields and the desire for money in the form of compensation.

Those people who live in the immediate vicinity of the mine had very high expectations about the improvements in living standard that they might enjoy. Roads, services and housing were at first the major concerns, but as these have been established, and people find themselves still living without a regular cash income, so they are seeking ways of gaining cash. Young men consider garden work demeaning and ‘old-fashioned’, and many refuse to carry out the tasks of clearing and fencing that were formerly their responsibility. The decline in subsistence production for domestic consumption means that people are doubly disappointed, as they need to buy rice and have no income.

As the decline in production coincides with the establishment of the mine, so it is attributed to the effects of various forms of pollution that people believe are affecting the air and the soil. This perception is due to both a genuine belief that pollution, in the form of poisonous gases from the mine’s processing plant, is enveloping the island, and to claims for compensation because compensation claims have provided a means of getting cash. In this sense, then, ‘environmental damage’ has become an economic resource.

The majority of claims are from villages that have experienced great increases in popu-

lation, causing intensive use of surrounding land for gardening. In areas around the northern village of Kunaye, where the soil was thin and poor to begin with, the overcropping is already a major problem. The small offshore island of Malie, which did not have sufficient land to sustain traditional swidden agricultural methods before mining began, is at crisis point. Arable land is being degraded and degradation will continue unless drastic steps to change current land use practices are taken.⁵ Both of these densely populated villages are outside the Special Mining Lease Area (the area of greatest impact) but they are the communities that regularly place pressure on the company over environmental issues.

The Company's environmental surveys do not reveal any pollution that would affect garden land or crop yields. Quite reasonably, people are reluctant to accept the findings of those from whom they are demanding compensation. Most villagers surveyed in late 2001 firmly believed that the gases from the exhaust stacks of the power plant at the mine (which include sulphur dioxide [SO₂] and various nitrogen oxides [NO_x]) were generating acid rain that was poisoning their soils and causing declines in yields. Interviews with villagers who have gardens in the same areas but do not report smaller yams or poor crops yielded another interpretation. Several women suggested that since the mine began and women delay planting in the vain hope of getting men to assist them, gardens are often planted 'too late' and so miss the rainfall. Shoots wither, growth is retarded and yields are low. Another reason commonly given for low yields was that less work was being done in the gardens because people simply were spending less time in the gardens than before. They were going more often to town to socialize and spend money obtained from employed relatives. Most people, however, believed that air pollution was the primary reason for poor crop performance.

Unfortunately the Papua New Guinean independent consultant who was commissioned by the landowner organization to assess air pollution in 1999 did not deliver the report⁶ and this has meant that grievances have continued unabated. Plans to have two separate independent surveys into Agriculture and Aerial Emissions have been prepared, and these studies are to be commissioned by the Office of Environment and Conservation and Nimamar Local Level Government. If the results of these surveys are conveyed to people in the villages in an appropriate way, they might create an awareness of the need to modify current gardening methods and to return to the system of long fallowing — although the Misiman case puts this in doubt.

SHORTENING FALLOW PERIODS

In 1996 we conducted interviews with people in several villages to determine Lihirian land-use customs. At that time most people said that the system of gardening involved fallow periods of between 5 and 10 years. A garden would be planted with staples (yams and mami — mainly *Dioscorea alata* and *D. esculenta*) and harvested the following year. It might then be planted with other food crops such as sweet potato (*Ipomea batatas*), cassava (*Manihot esculenta*), aibika (*Hibiscus manihot*) or bananas (*Musa* spp), and gradually allowed to revert to bush. The traditional way of assessing whether the soil had recovered sufficiently was the height of the regrowth, particularly bamboo. As people believe that bamboo ash provides the best nourishment, thickets of bamboo had to develop before the area would be slashed and burned for a new garden. Most Lihirians still present this system as the ideal and are familiar with it, but many have abandoned it because of the pressure on accessible land.

While reversion to this traditional system would ensure that soil fertility was maintained for a much longer period, this would also mean that more new garden land would have to be cleared and that therefore the forest cover would be encroached upon at an increased rate. Clearing of the inland areas, which are more mountainous, would not only reduce the habitat of indigenous wildlife, but would also affect the forage areas for domestic pigs. Any reduction in the health of pigs will be attributed to mining impact in the way

that claims for dead pigs were presented in 2000 and 2001. But it will also mean that soil erosion will quite rapidly become a problem on Lihir.

Many of the fears about various forms of pollution and environmental impact that are voiced by Lihirians are those that are in some respects most fanciful and readily discounted by scientific analysis. Thus people claim that yams are smaller and leaves of tobacco plants (demonstrably affected by a common disease) are wilting because of 'acid rain'. The death of a pig was attributed to poisoning following its consumption of a dead fish which people thought had been killed by toxins in the sea. The autopsy performed by the government veterinary surgeon did not substantiate villagers' claims, which were in part opportunistic and possibly related to the fact that heavy rain had caused the sediment plume (generated mainly by surface runoff from the pit and roads) to extend further towards their island than usual. This generated fears of contamination of the reef.

These same villagers, from Malie Island, have made claims about reef degradation from the sediment plume. Our observations corroborate the findings of the company environment department and the independent scientists that the plume has had no measurable effect on the Malie reefs (Brewer *et al.* 2001, Rotmann 2001, Thomas *et al.* in press). This is in marked contrast to those reefs close to the mine that are regularly affected by high sediment loads carried by the plume. As the original environmental studies by NSR predicted, these have suffered high coral mortality (Rotmann 2001).

The experience of Misimans, who are now confronting 'life after the mine', suggests that issues of sustainability are only comprehended after the major damage has been done. Moreover, the type of subsistence economy that was eschewed during the mine life cannot be resumed, both because of the environmental degradation that has occurred, and because the skills of gardening have not been transmitted consistently to the next generation of people.

On Lihir currently, people are disinclined to engage in any sort of agricultural work if they can either find employment or gain money in compensation payments. Many young men are prepared to sit around 'waiting' for employment rather than work on the land. Their behaviour is shaped by calculations of the amounts of money gained from compensation or by wages — so that agricultural developments are viewed as 'uneconomic'. Attempts to start a range of cash cropping ventures have met with little enthusiasm and both the mining company and the government agriculture officers have difficulty in promoting primary industry. Even when materials, seed plants, training and assistance are provided people tend to lose interest once they realize that the mining company is not going to pay them wages to work on their project. 'Self-reliance' and sustainability are viewed as part of the 'old ways' and linked to the lack of 'development' that people wish to escape.

THE VALUE OF THE 'ENVIRONMENT'

These attitudes and values, perhaps more than any other factor, mean that communities are disinclined to demand the environmental standards of mining that environmental NGOs would like. They prefer to receive the payments for damages rather than an environmental regime that prevents damage and yields no cash flow. The experiences of Integrated Conservation and Development (ICAD) projects at Lak in New Ireland Province and the Bismarck-Ramu region illustrate the problems faced by international environmentalist groups in Papua New Guinea. When such groups state 'The richness of PNG's biodiversity is a reserve, an asset, both for the population of PNG itself, and for the world' (Ellis 1997:1), they assume that the values that local populations placed on this 'asset' are similarly sensitive to the intrinsic value of its biodiversity, to the aesthetic value of its natural beauty, and to ideals of conservation. For most PNG villagers, the recognition that they depend on their natural resources for subsistence is 'taken-for-granted'. They want their land to have cash value, preferably in the form of rent, so that they can gain the goods and services they lack. Few seem to really believe that the land will be *irreversibly* damaged, much less lost to them forever.

The problem of retrospective awareness of the deleterious effects of mining is difficult to deal with. This is apparent in the Complaint filed by several Bougainvillean men against Rio Tinto:

“When the mine first came,” another Bougainvillean has declared, “everything was so new, we didn’t know what to expect. The thing what (sic) we were becoming so ignorantly proud of was that it was the biggest open-cut mine in the world. At that time, our thinking was that money can be a supplement to our way of life. But now it’s not only that, it is chewing and going right into the people’s life and that has disturbed a traditional balance that has existed.” (United States District Court, Central District of California, Western Division 2000:40).

In the early stages of negotiations, most people are so eager for economic development that they do not consider the long-term adverse effects, especially when the projected mine life is more than ten years. This lack of concern for the future is entirely comprehensible as a ‘cultural trait’ in communities where there have been few dramatic economic transformations and there is a perception of deprivation and backwardness. The short time-horizon has been observed as a factor that frustrates the objectives of both conservationists and development economists in Papua New Guinea. Writing of a failed Integrated Conservation and Development project at Lak (also in New Ireland Province) that aimed to thwart the deprivations of a Malaysian logging project, Van Helden (2001) cites a Conservation Resource Centre document that identified reasons for their failures: ‘Living for the short term: ...The backbone of conservation theory is based on the premise that we should take actions now that will safeguard the future of those yet unborn. In Lak these attitudes do not prevail. Typically it is the older members of the community who desperately crave development so that they may amass as much wealth as possible before they die. The attitude to their children, and to future generations, is one of ‘let them make their own way...and take their own chances’ (van Helden 2001:101).

It has been our experience in a number of development projects, including those on Lihir and Misima, that women are generally much more concerned about the future than men, and less beguiled by the lure of ephemeral cash. But in PNG women have little political force in negotiations and their views are often dismissed by their menfolk (see also van Helden 2001:277–79 and The World Bank 2003).

GAINING INFORMED CONSENT

On Misima, for example, the mining company, Placer Dome Pacific, was well aware of the probable effects of sediment on the streams and the sea. They knew also that Mt Sisa would eventually become a hole in the ground. Yet they wanted to be sure that people understood the scale of the project and the extent of loss, damage and destruction. The scale models of the plant and pit, and the scientific descriptions of sediment loads and the submarine disposal system, were not written in terms that were grasped by people in the villages that would be affected. The Community Relations manager, the independent environmental scientists from NSR and Martha Macintyre all discussed ways of imparting this knowledge in terms the villagers would comprehend. To this end, three activities were organized. First, people from the affected villages would walk around the whole area that would be stripped of forest and/or mined so that they would gain a clear understanding of the size of the mine and the areas that would be lost to them. Second, the environmental scientists put a harmless red dye (of the sort used by dentists as plaque-disclosing fluid) into the sea so that all villages could see the extent of the sediment plume that would exist during operations — and the areas of reef that would be lost. Third, the mining company took all the village leaders to Kidston, another Placer open-cut mine in Australia of about the same dimensions as that

proposed for Misima, so that they could see and report to others just how large this ‘hole in the ground’ would be. Village meetings were held to ensure that all of these impacts were understood; explanations of the rehabilitation scheme were offered for discussion and people were encouraged to ask questions. Fourteen years later, when the population has doubled, there are obviously many people who were not party to these activities during negotiations, but it is false to represent the signatories to the initial agreement as having not been consulted or having not given ‘informed consent’ (Evans *et al.* 2001). The real problem is that at that time people were prepared to lose their mountain, to have muddy water in streams and sea and to live forever with a big hole in the island where once they had gardened, buried their dead and hunted — because they envisaged a new life with money, cars, schools, motor boats and Western-style houses. Martha Macintyre noted at the time just after the red plume filled the bay in front of Narian village that our attempt to get men to acknowledge that they would not be able to fish there was met with the response, ‘We’ll buy tinned fish!’ and ‘You look, the sea is fine everywhere else, we’ll have plenty of places to fish!’

On Lihir, a decade later, during negotiations we were aware that Misimans were now claiming that they had been duped and accordingly we tried to develop explanatory strategies so that actual and possible consequences were understood. In discussions with the Environmental Manager and the Community Relations Manager it was suggested that a ‘worst-case’ scenario be presented to people about the effects of sediment run-off, tailings disposal, rock waste dumping and the bulldozing of the thermal pools and rocks in and around Luise Harbour. The environmental manager balked at this, but in several meetings the company negotiators stressed that Luise Harbour and its environs would be transformed and its resources and local uses lost to the communities who lived there at that time. Lihirians accepted the loss of terrestrial and marine resources, but demanded higher rates of compensation than had previously been paid by companies in PNG.

The Kennecott Joint Venture (the mining company then in negotiation with landowners on Lihir) took landowner representatives to Bougainville in 1986 so that they could meet with people around the Panguna area and hear at first hand their views on the adverse social and environmental impacts of mining. Colin Filer, who undertook the first two Lihir social impact studies with Richard Jackson (Filer and Jackson 1989), accompanied the group. They visited the mine and they met with Francis Ona, leader of the BRA, and other opponents of the company who advised them to drive a hard bargain and never to trust white men. Filer’s unpublished report noted that the Lihirian contingent were most impressed by some of Francis Ona’s advice about negotiations, and predicted that Lihirians would concentrate on the following issues:

- (a) The provision of housing — not only the type of housing to be provided, but also the question of subsequent maintenance and the manner of dealing with changes in household size. The ideal solution would be a ‘self-help’ solution, in which the Company provides the landowners with building materials on an ongoing basis, so that they are able to construct and subsequently adapt their housing to their own requirements. The Panguna experience suggests that Company-built houses will not be properly maintained by their occupants, but the occupants will blame the lack of maintenance on the Company itself. On the other hand, a ‘self-help’ solution may not be acceptable to the landowners themselves.
- (b) The provision of ‘social services’ — health and education facilities, water supplies, a ‘community centre’, and so forth. Again the demand will be for the Company to accept a continuing commitment, rather than a ‘one-off’ provision.
- (c) Compensation for destruction of crops (especially cash crops) and marine pol-

lution. In view of complaints made by the PLA representatives on this score, I would expect that demands will be way in excess of the rates currently recommended by the Valuer-General. (Filer 1988)

The Lihirians listened attentively during this meeting, but they also observed the favourable housing standards, the electricity supplies, the trucks, the Bougainvilleans dressed in smart clothes, the hospital and schools. Francis Ona's harangue did little to dissuade Lihirians of the economic benefits of mining. While Bougainvilleans stressed the damage done to their environment, they also encouraged the view that the appropriate local response would be to demand massive amounts of compensation rather than require higher standards of environmental preservation. One of the men who attended wrote a report for the Community Relations office and observed 'Francis Ona was a very cross man.'

At the time of negotiations over Bougainville in the late 1960s, it might well have been the case that no local people understood issues of environmental degradation. But this view is impossible to sustain in Papua New Guinea thirty years later. The Lihirian community representatives who were signatories to agreements in the 1990s included several men with tertiary education, and people within the broader community knew of the environmental problems associated with mining and logging in Papua New Guinea. The environmental problems of Bougainville and Ok Tedi have been well-publicised in the country and at that time there were several Bougainvillean families (refugees from the conflict there) living on Lihir.

Attempts to raise local consciousness about the possible damage to the environment failed. In negotiations about the mining lease, local people did not raise fears about degradation; they argued instead over the amounts of money that would be paid for it. The only area that was preserved was Alaia, the large rock on the northern side of the caldera that had cultural and spiritual value as the place where the spirits of the dead traditionally entered the afterlife. While people were happy to elucidate the many economic uses of the hot springs at nearby Kapit, no villagers shared our view that these were perhaps valuable because of their natural beauty. Villagers cited their uses of the area for cooking food and collecting sulphur crystals from rocks for use as body decoration. Women stressed the dangers of the heat and many suggested that the horrible rotten-egg gas smell that pervaded the place would not be missed at all.

LIHIRIAN CONSTRUCTIONS OF THE IMPENDING CRISIS

After five years, Lihirians are observing changes and some are worried about them. These worries have not yet translated, however, into demands for 'greener' practices. At the latest review of the mining agreement, local people demanded that in view of their anxieties about the long-term impact, the company should pay a 'Living in Fear' allowance. The fears they have for the future include cataclysmic events such as volcanic eruption (which they believe will occur because the mine will excavate to such depths that it will penetrate the earth's crust), the drying up of all rivers (associated with the sinking of bores into thermal areas near the pit so that steam gushes out), and dramatic flooding of the coastal strip due to the rise of sea levels (which they attribute to the mine's dumping of rock waste in Luise Harbour). The report on these fears prepared by one of the company's environmental officers reveals most clearly the ways that people combine snippets of scientific information with their own observations and experiences of environmental change.

* Dumping of soft waste rocks via dumping barges. Fear attributable to this is the observing of abnormal rising of sea levels. When a high tide occurs and the tide-mark reaches beyond the normal beach line, this tends to create certain element of fear in the people. They have stated that, these abnormal tides were never

seen before in the times of the *tumbuna* and now with the project just across the waters at Putput dumping waste rocks into sea, it is causing this change in the sea to go beyond the normally visible tide mark. The sea level rise here on Lihir is directly attributable to mining project.

- * Smoke Emissions from the Process Plant power station. Fear attributable to this is the gases from the power station forming over the island and eventually falling back to the ground (Lihir) as 'acid rain'. They state that, when these gases are spewing out of the processing plant, it is carrying dangerous gases. Once these gases go into the atmosphere, they merge into the clouds and form part of it. And when it rains, all the chemicals then form 'acid rain' and fall to the ground, where it taken up by plants, as water in the tanks where households drink and cook with this water. Then causes all these sicknesses we never experienced before the mine came. The second fear generated in the people's minds is the lower yields of their basic subsistence food crops and other economic tree crops in their gardens. This reduction in yield is connected to the high increase of smoke emissions from the mine.
- * Dust/Sediment Plumes (Barge dumping or surface runoff from the pit and road). Fear connected with this is the blanketing act it has on coral reefs and thereby forcing coral reefs to die and fish to flee the coastlines. There are two associated fears here, first is the fear generated by children and adults coming up with certain skin infections and people when out fishing find it very difficult to catch or spear a fish (diving). With the skin infections, they claim that, because of the chemicals used to process and extract gold, these are released into sea and we get skin diseases. Our fish are being chased away by all this dust in the sea.
- * Lakunbut Sewerage outfall. The two coastal villages of Malie and Kunaye claim they do not fish anymore because waste from the Lakunbut sewerage outfall has led to fish feeding on human waste. Further to is the fear that, because human waste is discharged in this area, people do not eat the fish caught around Lakunbut bay and develop skin infections from swimming in the sea where the tides carry this waste back and forth between Malie and Kunaye.
- * Putput Tailings Outfall. Fear generated by this method of waste disposal is enormous. The coastal villages of Malie, Putput, Londolovit, Masahet, Mahur and those on Niolam, most people are claiming that, tailings have caused skin infections, killed off our fish and other sea life, killing our coral reefs, releasing all kinds of dangerous chemicals like cyanide into the sea, polluting our marine element and forcing us not to wash our food with seawater (our natural salt) and cooking food in mumu pits. Now we have to buy expensive salt packets from the store.
- * Too Much Rain. Before the mine came, there used to be less rain, but today we have too much rain. The fear in the people's minds is the link between acid rain and constant rainfall. People have seen black sooty-like stuff blanketing most banana trees, leaves of breadfruit trees, beetle nut trees, yam leaves etc. and suspect this as acid rain.
- * Volcanic Eruption & Smoke. There is a general fear in the people's minds about another volcanic eruption like the twin Rabaul volcanoes. This is borne by the fact that, LMC is continuing to dig deeper and deeper into the ground as well as the hot steam gushing out in the pit. Very soon, LMC will cause the Luise Volcano to erupt and kill our sons and daughters, husbands and wives, brothers and sisters working at the mine.

(Report to Lihir Gold Community Relations Section, 2001)⁷

These fears are genuine insofar as once they are in circulation, many people believe them, and they combine ideas gleaned from a number of sources. Most of the envisaged catastrophes are based on unscientific extrapolations of ideas local people have about the physical processes that they observe of mining operations. But they also incorporate information that people acquire through the media — for many Lihirians now have radios and they regularly read newspapers. News about the rising sea level and its effect on low islands such as the Duke of Yorks and Tuvalu; stories about acid rain in Europe and Lihir's proximity to Rabaul, where the devastating effects of volcanic eruption are everywhere visible — these are woven into their local observations of the barge dumping and the muddy plume in Luise Harbour, the steam and smoke issuing from the pit and plant site (respectively), and the constant excavation of the pit. The rainfall records for Lihir show no increase in annual rainfall since the mine has begun; in fact the El Nino effect meant that there was a drought in 1997 that no doubt affected fruit and nut trees. The health records show no 'new diseases' over the period of the mine. Malaria infection has declined in villages close to the mine. Immunization rates for infants are now higher than anywhere else in Papua New Guinea. There has been a dramatic decline in skin diseases (especially in children), possibly due to improved hygiene because of the installation of tanks and reticulated water supplies. The black substance on some species of trees on Niolam has been identified by the government agricultural officer as a common sooty mould that seasonally afflicts leaves and fruit in many areas of Papua New Guinea. A strong current courses between Malie and Kunaye which removes any nearshore pollution very quickly. But the fear of pollution from sewage also has to be seen in the context of Lihirian reluctance to use lavatories — the lack of sanitation in villages generally is a far greater health risk than that posed by human and animal excrement in and around villages. The main point is that treated sewage from the camp is *new*, whereas Lihirians are accustomed to the sight of human, dog and pig excrement on beaches and around villages and so see it as harmless. Given that many of the claims are readily disproved, many fears must be seen as imaginary (and symptomatic of general unease associated with dramatic changes), disingenuous or possibly deliberately fraudulent.

Few environmentalist NGOs have visited Lihir to attempt to explain or discuss the environmental impacts to local people and those who have made very brief forays appear to have concentrated on DSTD and its possible effects. The brevity of their contact means that the only influence they have had is to introduce confusion about tailings and rock waste disposal. Lihirian fears about the sediment plume stem from the misconception that this in fact is comprised of tailings (which they know include toxins as the Company information sessions during negotiations included awareness about the use of cyanide and the nature of tailings). As some environmentalists also blur the distinction in their own publications (Evans *et al.* 2001; MPI 2002; Moody 2000) they make it easy for the mining company to point out that they are not only making false accusations, but that their criticisms about the effects of the plume are readily disproved by scientific tests. While this approach might allay the fears of educated Westerners, it does not really resolve the problem that local fears often conflate misconception and misinformation — and that they are presented as a reason for gaining more money as compensation. In such a politicized atmosphere it is extremely difficult to explain processes and gain the informed consent of landowners to any environmental impact.

POLITICIZED ECOLOGY AND INFORMED CONSENT

The issue of informed consent is crucial in Papua New Guinea. The government has no control over the leasing of the land to be mined, which is owned by local communities according to customary rights. Moreover, to date government departments have evinced little interest in seriously monitoring the environmental and social impacts of mining. However, many environmentalists who criticize mining agreements with local landowners on the

grounds that they have not given ‘informed consent’ appear to labour under two major misconceptions. First, that no local people understand that mining irreversibly alters the landscape and natural environment. (In our experience on Misima and Lihir some do, some do not. Equally, there are those who see the relationship between environmental destruction and economic ‘development’ or modernization as a ‘trade off’ that they are prepared to make, while others do not.). This is clearly enunciated in the *London Declaration* of the Mines and Communities group, which incorporates romantic notions of ‘primitive communalism’ by assuming that all members of a group designated a ‘community’ unanimously agree on issues related to mining and the idea that if local communities were informed by anti-mining NGOs of the environmental and social impacts of mining projects, they would reject them (see <http://www.minesandcommunities.org/>). Second, that Papua New Guineans already possess a conservation ethic, so that if they were aware of the potential degradation to their land they would refuse to enter into any agreement.

During the construction period Martha Macintyre conducted village meetings with groups of men and women specifically to gauge expectations and to assess the extent to which there were tensions between villagers adjacent to the Special Mining Lease area (who gain most economic benefits) and those in the more distant villages — at that stage the latter had no infrastructural benefits apart from the road. In 1996 the majority of people living some distance from the SML maintained that they did not begrudge the Putput people their new houses and their money, because of the loss of land, the damage to the rivers and sea. These ‘outsiders’ believed that it was fair that Putput people benefited more and that they had precedence — although they also thought that eventually they too would share benefits such as housing, electricity and water supplies. During those discussions, Lihirians gave every indication that they understood the sort of environmental damage that would occur and that they considered all the infrastructural development, employment opportunities and royalties to be ‘compensation’.

The demand for a ‘Living in Fear’ allowance has emerged in the context of increasing demands for compensation as moneys have been spent and people realise that there is not going to be a ‘trickle down’ of wealth from the landowners in the SML to their clanspeople beyond. There is now a well-founded fear that Lihirians will not reap the benefits they expected. There are also millenarian ideas of impending cataclysm that have been a consistent part of Papua New Guineans’ engagement with ‘development’ and modernity (see Worsley 1957; Sturzenhofecker 1994; Kocher Schmid 1999) since the early colonial period. Writing of responses to the 1998 Aitape tsunami, Christin Kocher Schmid observed:

Fear and dissatisfaction seem to be the prime driving forces: fear about the things to come, dissatisfaction with the current situation, but also the attempt to participate in these changes and to gain a certain degree of control over them. (Kocher Schmid, n.d., 1)

Events such as the volcanic eruption at Rabaul in 1994, the drought of 1997 and the tsunami reinforce general anxieties about environmental changes that have become common knowledge through the publicity surrounding lawsuits relating to Ok Tedi and Bougainville. Partial understandings of scientific information and rumours about various types of pollution are combined with their own observations and experiences of ecological change and all are linked to ‘the mine’.

Escalating compensation demands for environmental damage must be understood not simply as responses to ecological transformations that are considered negative, but as highly politicized strategies whereby Lihirians hope to increase the amounts of financial benefit from the mining company and extend its constituency. Banks has noted a similar strategy employed by villagers in the Strickland River area (Banks 2000:217–230). The major point at issue, on Lihir as on Bougainville, is of *sovereignty*. Lihirians reject the rights of the State over mineral resources.⁸

Lihirians know that the mine is predicted to operate for 35 years. The political tactics and the demands they make now are not driven by environmentalist concerns, but by the desire of ‘landowners’ within and adjacent to the SML to increase their share of the profit from what they perceive as *their own* resource, and by the rest of the population to force the mining company to distribute benefits beyond the narrowly defined group who hold land in the lease area. This explains the claims about air pollution and the allegations of toxicity in the sediment plume affecting reefs distant from the mine. These forms of widely dispersed pollution would affect more *people* and so enable claims for a broader distribution of compensation. The claims by villagers are thus best understood as protests against emergent economic inequalities and demands for political representation as ‘Lihirians’ who have sovereignty over their resources. When Lihirians outside the mining lease area make claims about gases and poisons in rain and ocean, they are in effect arguing a case for the broader spread of benefits (especially cash) to all Lihirians. All benefits and compensation payments are a form of ‘resource rent’ (Filer 1997). After five years of production, Lihirians embrace the discourses of environmentalism and impending ecological catastrophe primarily to use them as leverage in negotiations with the mining company over higher payments to a broader constituency.

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NOTES

1. Martha Macintyre worked as an anthropological consultant on Misima in 1986 preparing a Social and Economic Impact Study commissioned by the PNG Government Department of Minerals and Energy and the Australian Government’s Export, Finance and Investment Corporation (EFIC). Her work on Lihir began in 1994 before the construction phase of the mine when she prepared an independent Social Risk Assessment for EFIC, Lihir Gold Limited and the PNG Department of Environment and Conservation. When the contractual relationship between EFIC and Lihir Gold finished in 2000, the company and the Department of Environment and Conservation decided to continue the practice of having independent, external monitoring of social impact, so her services were retained. Simon Foale is a zoologist and marine biologist whose doctoral research entailed a study of customary marine tenure and local knowledge in fishery management at West Nggela, Solomon Islands. His work on Lihir began in 1998. It initially focussed on fisheries and the extent to which Lihirians utilised or depended upon marine resources, while assessing mining impacts on local practices. Since 2000 he has collaborated with Martha Macintyre in monitoring social and economic impact of the mine on Lihir. His research for the Millennium Ecosystem Assessment project (a collaboration between The University of Papua New Guinea and The Australian National University) has focussed on the Lihir group of islands and Milne Bay Province (which includes Misima), concentrating on the changing ecology of coastal zones, coral reefs and small islands.

2. Deep sea or submarine tailings disposal has been heavily criticized by many groups and is deemed by environmentalists to be in breach of international agreements relating to sea dumping. We are not defending its use on Lihir or Misima, simply observing that the dumping of soft rock waste is confusingly conflated with DSTD in the texts cited.
3. The tailings outfall at Lihir is 128m below sea-level (the productive zone of coral reefs peters out very quickly below 50m). This depth was calculated, through extensive research by NSR, to ensure that the chances of any upward transport of tailing material via vertical circulation cells or upwelling are extremely low. Ongoing quarterly and 6-monthly water quality monitoring by both the company and the government (Department of Environment and Conservation) verifies this. While the government's 'split sample' monitoring program has been sporadic, the water quality data we have obtained from them essentially corroborate the data supplied by the company, and show that with very few exceptions, the values for the parameters measured fall within ANZEC limitations.
4. Long chains of liability are apparently common in Melanesian cultures (see for example Akin 1999), and as other studies have shown are often invoked in order to claim compensation.
5. The intense land pressure on Malie Island has forced many of its inhabitants to use kin connections to obtain use rights to gardening land on the big island (Niolam). This practice commenced long before the mine arrived, as the population on Malie has been above carrying capacity for at least two decades. Nevertheless, soils on Malie continue to degrade because of dramatically reduced fallow time.
6. The reasons why the report was never delivered are unclear. One person suggested that it was because the findings did not support the villagers' claims and so the consultant (probably correctly) presumed that he would not be paid for his services. Another, less cynical interpretation was offered by a PNG scientist who knew the consultant, who claimed that he was unfamiliar with the instruments he used and was unable to produce an analysis from the data.
7. We gratefully acknowledge Mr Thomas Kevaro's assistance in supplying us with copies of his report.
8. Jacob Semos, a Bougainvillean who strongly supports the political stance of Francis Ona and the BRA, has written a PhD thesis (1997) in which he argues that in effect the major political issue was that of sovereignty. His descriptions of the causes of the Bougainvillean crisis include many parallels with prevailing views of Lihirians about their land and its resources — while few would use the term 'sovereignty', most would recognise the ideas of ownership and self-determination and the complaints against the mining company and the government.

REFERENCES

- AKIN, D. 1999. Compensation and the Melanesian State: Why the Kwaio Keep Claiming. *The Contemporary Pacific* 11:35–67.
- BANKS, G. 2000. Marginality and environment in Papua New Guinea: The Strickland River area. *Asia Pacific Viewpoint* 41:217–230.
2002. Mining and the environment in Melanesia: contemporary debates reviewed. *The Contemporary Pacific* 14:39–67.
- BANKS, G., and C. BALLARD, editors. 1997. *The Ok Tedi Settlement: Issues, Outcomes and Implications*. Canberra: National Centre for Development Studies and Resource Management in Asia-Pacific Project, Australian National University.
- BAYLISS-SMITH, T., E. HVIDING, and T. WHITMORE. 2003. Rainforest Composition and Histories of Human Disturbance in Solomon Islands. *AMBIO: A Journal of the Human Environment* 32:346–52.
- BREWER, D., D. DENNIS, D. MILTON, D. HEALES, B. VENABLES, G. FRY, T. VAN DER HELDE, A. KOUTSOUKOS, T. TARANTO, T. SKEWES, and S. BLABER. 2001. The Assessment of Mine Impacts on Lihir Island Fish Communities with an Estimation of the Potential Fisheries Resources: Second Year Report — December 2001. Brisbane: CSIRO and Lihir Management Company.
- BULMER, R.N.H. 1982. Traditional conservation practices in Papua New Guinea, in *Traditional Conservation in Papua New Guinea: Implications for Today*, edited by L. Morauta, J. Pernetta, and W. Heaney, 59–77. Boroko, PNG: Institute of Applied Social and Economic Research.
- BURTON, B. 2000. NSR backs ocean dumping. *Mining Monitor* 5:7.
- BYFORD, J. 2001. *One day rich: Community perceptions of the impact of the Placer Dome gold mine Misima Island, Papua New Guinea*. Melbourne: Oxfam Community Aid Abroad.
- CLARKE, W.C., and R. THAMAN. 1997. Incremental agroforestry: enriching Pacific landscapes. *The Contemporary Pacific* 9:12–148.
- CONNELL, J.H. 1978. Diversity in tropical rain forests and coral reefs. *Science* 199:1302–1310.
- DEPARTMENT OF AGRICULTURE AND LIVESTOCK. 1993. Didiman Newsletter. Vol. 25:10. Port Moresby: Department of Agriculture and Livestock.
- ELLIS, J.-A. 1997. *Race for the Rainforest II. Applying lessons learned from the Bismark-Ramu Integrated Conservation and Development Initiative in Papua New Guinea*. Waigani, PNG: PNG Biodiversity Conservation and Resource Management Programme.
- EVANS, G., J. GOODMAN & N. LANSBURY, editors. 2001. *Moving Mountains: Communities Confront Mining and Globalisation*. London: Zed Books.
- FILER, C. 1997. Compensation, rent and power in Papua New Guinea. In *Compensation for Resource Development in Papua New Guinea*, edited by Susan Toft. 156–190. Law Reform Commission of Papua New

- Guinea Monograph No. 6; Pacific Policy Paper No. 24. Canberra and Port Moresby: National Centre for Development Studies, Australian National University; Resource Management in Asia and the Pacific, RSPAS, Australian National University.
1988. *Report on a Visit to Panguna with Lihir Landowners, 2/11/88*. Boroko: University of Papua New Guinea.
1998. The Melanesian way of menacing the mining industry. In *Modern Papua New Guinea*, Edited by B. Burt, 147–178. Kirksville: Thomas Jefferson University Press.
- FILER, C., and R. JACKSON. 1989. *The Social and Economic Impact of a Gold Mine at Lihir: Revised and Expanded*. Port Moresby: University of Papua New Guinea.
- FILER, C., with N. SEKHRAN. 1998. *Loggers, donors and resource owners. Policy that works for forests and people series no. 2*. Port Moresby: National Research Institute.
- FLANNERY, T. 1998. *Throwim Way Leg*. Melbourne: Text Publishing.
- HYNDMAN, D. 2000. Dominant Discourses of Power Relations and the Melanesian Other: Interpreting the Erotized, Effeminizing Gaze in National Geographic. *Cultural Analysis* 1:15–33.
- KOCHER SCHMID, C. 1999. *Expecting the Day of Wrath: Versions of the Millenium in Papua New Guinea*. NRI Monograph 36. Port Moresby: National Research Institute.
- KOCHER SCHMID, C. n.d. Changing projections in the Kilimeri area (Sandaun Province, Papua New Guinea) before and after the tidal wave.
- KREBS, C. 1994. *Ecology: The Experimental Analysis of Distribution and Abundance*, 4th edition. New York: HarperCollins College Publishers.
- LUTZ, C., and J. COLLINS. 1993. *Reading National Geographic*. Chicago: Chicago University Press.
- MACINTYRE, M. 1983. Warfare and the changing context of ‘Kune’ on Tubetube. *The Journal of Pacific History* 18:11–34.
- MAY, R.M. 1973. *Stability and Complexity in Model Ecosystems*. Madison: University of Wisconsin Press.
- MEAD, A.R. 1973. A prognosis in the spread of the Giant African Snail to continental United States. *Malacologia* 14:437.
- MOODY, R. 2000. *Into the Unknown Regions*. London: Minewatch Asia Pacific.
- MORAUTA, L., J. PERNETTA, and W. HEANEY, editors. 1982. *Traditional Conservation in Papua New Guinea: Implications For Today*. IASER Monograph No. 16. Port Moresby: Institute of Applied Social and Economic Research.
- MPI. 2000. Mineral Policy Institute Website (http://www.mpi.org.au/rights/bougainville_class_action_article.html), Sydney: Mineral Policy Institute.
- MPI. 2002. Mineral Policy Institute Website (<http://www.mpi.org.au>), Sydney: Mineral Policy Institute.
- OXFAM COMMUNITY AID ABROAD WEBSITE 2003. <http://www.caa.org.au/campaigns/mining/index.htm>. Melbourne: Oxfam CAA.
- PLACER DOME ASIA PACIFIC STAKEHOLDER ROUNDTABLE. 2000 *Update On Actions On Sustainability At PDAP Since 1998*. Wednesday 29 March 2000, Novotel Hotel, Darling Harbour.
- RAPPAPORT, R.A. 1968. *Pigs for the Ancestors: Ritual Ecology of a New Guinea People*. New Haven: Yale University Press.
1971. Nature, culture, and ecological anthropology. In *Man, Culture and Society*, edited by H. L. Shapiro, 237–267. Oxford University Press.
- ROTMANN, S. 2001. *Progress report of 2001: Tissue thickness as a method to measure coral response to sediment stress on Lihir Island*. Townsville: James Cook University.
- SCOONES, I. 1999. New Ecology and the social sciences: what prospects for fruitful engagement? *Annual Review of Anthropology* 28:479–507.
- SEMOS, J. 1997. *Natural Resources, Nasioi Society and the Colonial and Post Colonial State in Papua New Guinea: The Mining and the Undermining of Resource Sovereignty and Resource Development in the Bougainville Copper Project 1963 to 1990*. Ph.D. Thesis, James Cook University.
- STURZENHOFECKER, G. 1994. Visions of a landscape: Duna premeditations on ecological change. *Canberra Anthropology* 17(2):27–47.
- THOMAS, S., P. RIDD, and G. DAY. in press (2003). Turbidity Regimes over Fringing Coral Reefs near a Mining Site at Lihir Island, Papua New Guinea. *Marine Pollution Bulletin*.
- UNITED STATES DISTRICT COURT, CENTRAL DISTRICT OF CALIFORNIA, WESTERN DIVISION. 2000. *Complaint, Alexis Holyweek Sarei et al. v. Rio Tinto plc, et al.*
- VAN HELDEN, F. 1998. *Between Cash and Conviction: The Social Context of the Bismarck-Ramu Integrated Conservation and Development Project*. Port Moresby: National Research Institute.
2001. Through the Thicket: Disentangling the social dynamics of an integrated conservation and development project on mainland Papua New Guinea. Ph.D., Wageningen.
- WEINER, J. 2001. Introduction: Depositing. In *Mining and Indigenous Lifeworlds in Australia and Papua New Guinea*. Edited by Alan Rumsey and James Weiner. 1–11. Adelaide: Crawford House Publishing.
- THE WORLD BANK, 2003. Women in Mining. An International Conference hosted by The World Bank, The PNG Department of Mining and Oxfam-CAA. Conference Proceedings (no place of publication)
- WORSLEY, P.M. 1957. *The Trumpet Shall Sound: A Study of ‘Cargo’ Cults in Melanesia*. London: MacGibbon and Kee.
- WWF Statement of Principles on Indigenous Peoples and Conservation
http://www.panda.org/about_wwf/what_we_do/policy/indigenous_people/preamble.cfm