SOPAC

1996 Annual Report Summary

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Foreword by the Director

Every year SOPAC produces its Annual Report Summary in the hope that readers will learn a little more about SOPAC, what it does, who it assists, and so on. However, reading some confused assumptions about SOPAC and its activities within the Australian Review of SOPAC carried out mid-year, reinforced our views at the Secretariat that there is not a general awareness, including within member governments, of what SOPAC does.

It appears, in fact, that not many people know precisely what applied geoscience is, how its activities benefit the region, or indeed, what SOPAC's team of technical geologists do. Our aim, therefore, in producing this year's Annual Report Summary, is to make the role of SOPAC clearer. This task is particularly important, as it has become apparent to us, over the past year, that lack of understanding of SOPAC's work could lead to a reduction in funding for the work carried out for island members by or through the Secretariat, and a possible cut back in the services it can provide to its island members.

This recognition has led us to try to make this Annual Report Summary more reader-friendly to encourage more donors and recipients to read about and understand the scope of SOPAC's work. To do this, we have placed the focus of this Annual Report Summary on the countries who have benefited from our services and the donors who have enabled us to provide these services. We have also tried to help readers by providing a Glossary of Technical Terms for the non-technical readers and highlighting all references to member countries throughout.

I hope that these changes make this document a more valuable source of information to member countries, donors and all other readers. I also hope that it will enable all readers to understand the valuable contribution of SOPAC to the sustainable economic development of the region, through provision of geotechnical services.

Finally, I would like to take this opportunity to inform all who read this Annual Report Summary that next year, 1997, is the twenty-fifth anniversary year of SOPAC which began in 1972 as a UNDP project and evolved into its present form as a regional organisation in 1986.

Philipp Muller in discussion with the Director of Mineral Development, Fiji (top) and with People's Republic of China officials (below).

D.A.P. Muller CSI, AM,
Director,

June 1997

Introduction to SOPAC

What is SOPAC?

SOPAC is the South Pacific Applied Geoscience Commission. It is an Intergovernmental, regional organisation dedicated to providing geotechnical services to the countries it serves. SOPAC's work is carried out through its Secretariat, based in Suva. The work programme is reviewed annually by the Governing Council assisted by: Secretariat representatives (SOPAC), a Technical Advisory Group (TAG), and a Science, Technology and Resources Network (STAR). SOPAC is funded by member-country contributions with support from donors.

What does SOPAC do?

SOPAC's work focuses on providing assistance to its member countries in three key areas: minerals and energy resource identification, promotion, and development; environmental geoscience; and human resource development in the geoscience field. To effectively deliver these services SOPAC maintains a regional data centre, provides information services, and offers technical and field services for specific project work.

Who benefits from SOPAC?

Any member country can request geotechnical assistance from SOPAC, however, only the island member countries do. Member countries are **Australia**, **Cook Islands**, **Federated States of Micronesia**, **Fiji**, **Guam**, **Kiribati**, **Marshall Islands**, **New Zealand**, **Niue**, **Papua New Guinea**, **Solomon Islands**, **Kingdom of Tonga**, **Tuvalu**, **Vanuatu**, and **Western Samoa**. **French Polynesia** and **New Caledonia** are associate members.

Benefits accrue to island member countries directly through the provision of basic geological knowledge, and indirectly through improvements in land use leading to greater returns to land, and more efficient use of the countries non-living resources, better health through improved water and sanitation provision, wealth generation through the development of mineral resources, and more sustainable development, by taking into account the geo-environmental impacts of developments. During 1996, all the island member countries benefited from assistance from SOPAC, either through country-specific assistance, or through one (or more) regional activity.

Who pays for SOPAC?

SOPAC is funded by member-country contributions and supported by the following donors: **Australia**, **Fiji**, Canada, France, Japan, **New Zealand**, Norway, People's Republic of China, the United Kingdom, the United States, and, the Commonwealth Secretariat, the European Union, and the UN family. Donors who helped fund country specific projects are mentioned in the Country Assistance section; those who provided other forms of financial assistance are mentioned in the section on Support Services.

General Regional Assistance

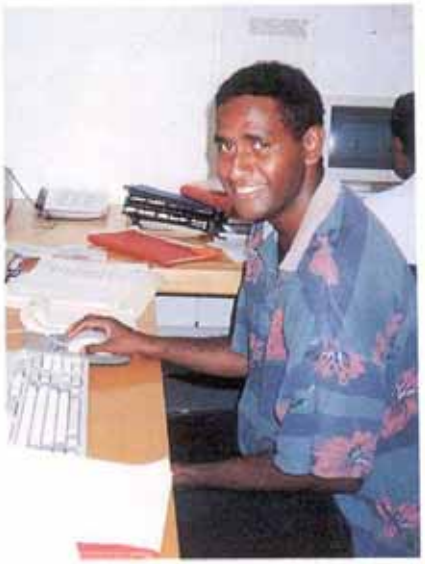
SOPAC's mission statement is:

"To improve the well-being of the peoples of the Pacific island member countries through the application of geoscience to the management and sustainable development of their non-living resources."

As such its major programs relate to the development of the non-living resources, namely, land, minerals, hydrocarbons, water, ocean energy, and geothermal energy. All these programs for resource development have input to the environmental geoscience activities of SOPAC.

Not all of these services are required by all countries. The resource-rich Melanesian countries generally request SOPAC's assistance to promote or develop their mineral or petroleum potential and for training. The smaller Micronesian and Polynesian countries, which are generally more isolated with fewer exploitable resources, have other needs, more often related to coastal development in particular the assessment of causes of coastal erosion, studies for alternative sources of sand and gravel, groundwater and sanitation improvements.

Yet some of SOPAC's projects benefit most of the countries in the region, such as the search for offshore minerals, training, data management and information technology. Those projects which provide assistance to the region as a whole, or to groups of countries are reported in this section.



Human resource development in the geoscience field is a key area which SOPAC work focusses on. Graduate trainees and technicians are presented with opportunities during Work Program activities or special workshops to upgrade and enhance their practical knowledge in the role and application of geosciences to national development strategies. These trainees from SOPAC member government departments are some of the direct beneficiaries of this focus.

Minerals and Energy Resources

The minerals and energy resources program covers a broad spectrum of activities including, assisting in the search for viable mineral deposits both onshore and offshore, assessing potential sources of sand and gravel for aggregate and investigating alternative sources of energy.

Minerals

The Melanesian countries generally have large natural mineral resource endowment. However, most need to develop and strengthen their financial and technical resources to assess the extent and quality of these resources, and, to promote their development. SOPAC's role is thus to identify and promote the onshore and offshore mineral potential of its member countries and the region in general.

Gold mining, Chovohio River, Gaudalcanal, Solomon Islands.

During 1996, to provide general assistance to prospectors and explorers who are interested in developing the regions minerals, SOPAC put substantial effort into creating a preliminary regional minerals database, and establishing the structure for a hydrothermal minerals database. The minerals program was directed almost entirely at the **Cooks Islands**, **Fiji**, **Kiribati**, **Papua New Guinea**, the **Solomon Islands**, and **Vanuatu**.

To promote and develop the regions offshore minerals, the Offshore Geologist visited the **Marshall Islands** and **Federated States of Micronesia** to discuss planning and implementation arrangements for the Hakurei-Maru No. 2 cruises in 1996, 1997 and 1998. The Hakurei-Maru No. 2 cruises are part of the third 5-year joint Japan/ SOPAC deep-sea minerals exploration project. SOPAC also continued maintaining the deepsea minerals, manganese nodules and cobalt-rich crusts databases for use by prospectors. Work on the results of the 1995 cruise in Tonga waters was completed and the report released.

KORDI officials at SOPAC to sign an MOU and to look at the SOPAC deepsea minerals databases.

As an indication of the success of SOPAC's promotion of its databases, during 1996 staff from the Korean Ocean Research and Development Institute (KORDI) visited SOPAC for two weeks to familiarise themselves with SOPAC's deepsea minerals databases. Information on the KORDI-USGS cruises in the waters of the **Marshall Islands** and the **Federated States of Micronesia** were exchanged.

Hydrocarbons

The petroleum potential of the South Pacific region continues to attract investors interest. So, despite the extremely limited resources available for the hydrocarbon program, SOPAC pursued its mandate to assess and promote the petroleum potential of the region by updating its petroleum data bases and undertaking limited promotional activities.

During the year, the SOPAC Petroleum Data Bank, housed at the Australian Geological Survey Organisation in Canberra, continued to catalogue the extensive data collection of seismic tapes, transparencies, reports, and maps held at the data bank. To ensure the information was up-to-date and relevant, the petroleum data catalogues for **Solomon Islands**, **Vanuatu**, **Fiji** and **Tonga** were reviewed and reproduced in a glossy brochure format.

Open-cast nickel mining high in the interior of Le Grande Terre the main island of New Caledonia.

The data collection, which is used primarily by petroleum exploration companies and consultants, was advertised through the distribution of brochures and at promotional events such as the workshop organised jointly by the **Papua New Guinea** Department of Mining and Petroleum, the Norwegian Petroleum Directorate and SOPAC. The workshop, on "Petroleum Economics and Promotion", was held in Port Moresby, and attended by participants from **Fiji**, **Papua New Guinea**, **Solomon Islands**, **Tonga**, and **Vanuatu**.

Promotional activities were also undertaken at the Australian Petroleum Exploration Association annual conference, where a booth was set up with a display on "New Exploration Prospects in the South Pacific".

Unfortunately, the viability of the regional hydrocarbon program is in question as no funding is available for staffing. This area was considered a priority area by only one member country in 1996.

Ocean and Geothermal Energy Program

While some of the Melanesian countries have access to timber resources, and hydroelectric power, most of the Micronesian and Polynesian countries have limited access to an indigenous power resource. Therefore member countries asked SOPAC to look at realistic alternative energy sources with potential for development in the region. In this regard, SOPAC has been involved for some years in conjunction with Norway in exploring the possibilities of developing ocean energy and, in more recent years, geothermal energy sources.

Ocean energy could be a source of cheap sustainable power to many countries in the region. How to harness that power has been the focus of SOPAC's activities in this program for some years. During 1996 this activity was concluded with the completion of a glossy brochure, entitled "Ocean Wave Energy in the South Pacific - the Resource and its Utilisation", which reviews the wave energy potential in **Cook Islands**, **Fiji**, **Kiribati**, **Tonga**, **Tuvalu**, **Vanuatu**, and **Western Samoa**. The brochure is intended to attract investors who could advance the possibility of developing wave power stations and distributing electricity harnessed from waves in the South Pacific.

The ocean energy program also maintains an excellent wave database which has proved valuable both to private companies and member countries. The private companies bought the information in one case, to assess the impacts of storm surge on private shoreline developments, and in another to determine the optimum size (for maximum comfort) of boats for passenger cruises. The member countries will further benefit from the database as it can be used not only to assist in the assessment of wave energy as an alternative power source, but also to determine the contribution of waves to coastal erosion.

During 1996 the ocean energy databases were also made available to two national ocean observation programs: the Japan Marine Science and Technology Centre (TRITON/JAMSTEC) and the United States' Tropical Oceans and Global Atmosphere Program (TOGA).

Geothermal energy resources exist in the region: in **Fiji**, **Papua New Guinea**, **Solomon Islands** and **Vanuatu**. SOPAC has the mandate of assisting member countries to determine whether these resources can be developed into viable alternative energy sources. However, during 1996, the work of the geothermal energy program was limited to writing and producing articles in conjunction with the East-West Centre in Hawaii.

Environmental Geoscience

Almost all the Pacific Island countries are physically small in size, remote, and in some cases, widely scattered. Natural disasters besiege the islands. Tropical cyclones, earthquakes, floods, tidal waves, tsunami, storm surges, volcanic eruptions, landslides and droughts affect almost all the islands. While some countries are particularly vulnerable to tropical cyclones, which destroy vital natural resources, as well as infrastructure, the coral atoll islands are subject to tidal wave damage, coastal erosion and the effects of climate change and sea-level rise.

Threats to the Pacific Island countries also come from human activities such as sand mining and dredging which are causing coastal erosion.

All of these problems can cause substantial disruption to the developing economies of the island countries in the region, particularly as the coastal regions which are generally the most heavly populated, often are the location of most of the country's infrastructure and the area of greatest economic activity.

Consequently, the focus of the environmental geoscience program at SOPAC, is to promote an understanding of the threats to the Pacific Island countries' coastal areas, the water resources available to communities living near the coast, and their sanitation The environmental geoscience program addresses the problems by means of an 'identify, inform, improve' approach. The issues, causes and solutions are first identified, then the information is disseminated to enable affected people (or people at risk) to work towards improving their circumstances.

Coastal Mapping

Coastal mapping tackles the first 'I'. Identify.

Concerns about the effects of: sea-level rise (particularly to the low lying small Pacific Island states), shoreline erosion, river siltation and mangrove retreat are very real and growing. During the year, to assess the possible impacts of these

phenomena, vulnerability studies began in **Fiji**, and a coastal erosion/sedimentation investigation was completed for Kosrae in the **Federated States of Micronesia**. These studies required aerial photos of coastal morphology, however parts of the **Federated States of Micronesia** are frequently cloud covered. For parts of such islands, the current optical system is inadequate and so preparations are being made to acquire synthetic aperture radar images (SAR) of selected areas in the region. Mapping by use of SAR images is at the forefront of aerial photo technology.

Most Pacific Islanders are fully aware of the earthquake risk in the South Pacific region, however, few can offer concrete advice to town planners and developers about the most risky areas, and the potential size of the earthquake threat.

Earthquake risk assessments for parts of **Fiji**, and **Solomon Islands** have already been carried out, and preliminary mapping work has been completed for the onshore part of the project. Preparatory groundwork has commenced for the micozoning of Port Vila (**Vanuatu**), and Honiara (**Solomon Islands**). The work should enable city planners to better assess the earthquake risk associated with building in these areas, and should lead to safer town planning. The equipment for the work is provided by the Israeli Government, although the majority of the costs are borne by the United States Government.

The vulnerability of coasts to natural and man-made disasters should interest all island dwellers. Top right, Director Muller with Israel's Avi Shapira. Shapira is testing a new and much easier method for earthquake risk assessment. SOPAC's role is to provide the geological mapping of the test areas: the cities of Suva, Nuku'alofa, Honiara and Port Vila. As a consequence detailed geological maps of some of these cities will be available that should enable city planners to make better-informed decisions for municipal projects.

Right, the Sandy Beach Hotel restaurant block under attack from Northerly swell waves breaking on the beach fronted by a narrow fringing reef on the northeast coast of Kosrae, Federated States of Micronesia. The swell waves were produced by a distant low pressure system and the weather on Kosrae was beautiful, sunny with no wind at the time.

Offshore Mapping

The Pacific Island countries are dispersed over an area in excess of 20 million square kilometres, but the actual land area of the countries amounts to just over 0.55 million square kilometres, with **Papua New Guinea** land area accounting for 0.46 million square kilometres of that area. Therefore despite limited land-based resources most of the Pacific Island countries have a vast area of potentially well-endowed ocean resources within their Exclusive Economic Zones (EEZ).

The offshore mapping program tackles the second 'I', namely it provides Information, particularly on seabed shape (bathymetry), but also seabed type and seabed structure. The program is specifically intended to assist the member countries gain a greater understanding of the submarine mineral and living resource potential of the EEZ areas to enable those countries to promote and if feasible, develop those resources. To develop that greater understanding of the mineral potential, the offshore mapping section should be undertaking seabed mapping, cruise coordination, and data collection, as well as providing information on EEZ's to member states.

During 1996, without an offshore mapping coordinator, this work has been substantively reduced. SOPAC continued to coordinate the activities of research vessels and geoscientific cruises in the region and assisted member country nationals participate in these cruises. This means that the data continues to be collected but no analysis is being undertaken by SOPAC or its member countries. It is the analysis of this data which is critical if the data can be used to assist the member countries. At present, the new bathymetry data collected during these cruises is being incorporated into the SOPAC databases, and SOPAC continues to reproduce and distribute CD-ROM's of the SOPACMAPS data.

To enable its member countries to claim further sea resources, SOPAC continued to collaborate with the Forum Fisheries Agency to produce guidelines for the establishment of continental shelf extensions beyond 200 nautical miles under Article 76 of UNCLOS.

French and American research vessels berthed at the Suva wharf, top and left. Directly above, the Norwegian-crafted Korean research vessel Tamhei II expected to work in the SOPAC region in 1997.

The water and sanitation program tackles the third 'I' - Improve - by attempting to improve the health of those in member countries with water and sanitation problems, by improving the quality of potable water resources. In 1996, SOPAC was involved in the establishment of the Pacific Water Association by hosting a steering committee meeting and by assisting in organising the inaugural meeting of the Association in American Samoa.

Efforts were also focussed on disaster mitigation, in particular to minimise the effects of drought in the region. One of the many contributing factors to drought events in the Pacific, is the lack of potable groundwater. To improve the quality of groundwater available to the regional countries, SOPAC and UNESCO/IHP began two research projects. One, in **Tonga** looked at ground water pollution. The other was started in **Kiribati** to study groundwater lens recharge and identify how much freshwater could be extracted from the ground without the risk of saline intrusion. SOPAC in conjunction with the Commonwealth Secretariat provided funding for nationals from **Tuvalu**, **Western Samoa**, **Cook Islands** and **Federated States of Micronesia** to participate in these projects. For both projects, SOPAC ordered the equipment and provided technical backstopping.

An important ongoing aspect of this work program is to foster closer cooperation and collaboration among countries, donors and other agencies to ensure that its objectives are met in the most cost-effective, regionally appropriate manner. During the year SOPAC worked towards this by:

- hosting the UNEP Workshop on Technologies to Augment Freshwater Resources in Small Islands Countries. Representatives attended from **Australia**, **Fiji**, **Federated States of Micronesia**, **French Polynesia** and **Kiribati**; and by,
- organising and hosting (in Suva) the UNESCO/IHP Working Group Meeting for the research projects implemented in **Kiribati** and **Tonga**.

Human Resource Development

Human resource development is vital to the sustainable development of the region. If skills are not transferred from SOPAC staff to country nationals, and the in-country institutions are not strengthened, then skills will continually need to be imported, and projects in that sense will not be 'sustainable'.

SOPAC promotes human resource development by directly teaching courses, subsidising the education of member country nationals by fellowships and scholarships, providing hands-on training, and utilising and advertising the specialist technical skills of member country nationals.

Direct education is provided both through the ongoing Certificate in Earth Science and Marine Geology, and in recent years, through GIS and remote sensing computer courses which have gained a reputation for excellence. In 1996, 25 students from: **Cook Islands**, **Fiji**, **Kiribati**, **Papua New Guinea**, **Solomon Islands**, **Tonga**, **Vanuatu**, and **Western Samoa** embarked on the first year of the Certificate in Earth Science and Marine Geology course, while GIS training was provided to the staff from the Forum Fisheries Agency, UNDHA-SPPO, **Fiji** Government Departments, and the **Fiji** Land Information Service. Attachments were

also provided for participants in the GIS courses from **Cook Islands**, **New Caledonia**, **Solomon Islands**, **Tonga**, **Tuvalu**, and **Vanuatu**.

SOPAC staff also continued to provide assistance to the University of the South Pacific, by teaching elements of the undergraduate Marine Studies, Ocean Resources Management and Applied Geology courses.

During 1996, SOPAC supported scholarships for eight students wishing to attain degrees in geology, engineering or applied science. Through SOPAC, Canada funded scholarships to nationals from the **Cook Islands**, **Tonga**, **Tuvalu**, and **Vanuatu**. **Australia** funded one scholarship to a Tongan national, and jointly with **New Zealand** funded one scholarship to a Western Samoan national. The European Union funded a scholarship to a national of the **Solomon Islands**. During 1996 three scholarship students from **Cook Islands**, **Tonga** and **Tuvalu** completed their courses and graduated.

SOPAC's hand-on training, was provided in the form of fellowships. These 2-week to 3-month attachments to SOPAC were provided to thirty member country nationals from the **Cook Islands** (1), **Fiji** (6), **Kiribati** (2), **Marshall Islands** (1), **Papua New Guinea** (6), **Solomon Islands** (2), **Tonga** (5), **Tuvalu** (2), **Vanuatu** (3) and **Western Samoa** (2). During 1996, there were five research vessels in the region, which had six participants onboard from four countries: **Fiji**, **Tonga**, **Papua New Guinea** and **Marshall Islands**. The other organisations which accepted attachments from the SOPAC Fellowship Scheme during 1996 included the Australian National University, the University of Hawaii, and Metal Mining Agency of Japan. Together, they supported five attachments from **Papua New Guinea**, **Tonga** and **Vanuatu**.

Melanesian students on the Earth Science and Marine Geology Course.

SOPAC also continued work towards promoting the use of regional personnel in the geoscience field. During the year SOPAC developed a regional database of technical personnel and drillers with specialist water and sanitation skills. A first draft of a geoscience capacity database for SOPAC member countries was also completed.

Specific Country Assistance

SOPAC's island member countries face a multitude of different economic and environmental constraints to growth. Therefore SOPAC has to provide a multitude of different resource management and development services as specific country assistance to enable it to meet the real needs of each island member country. These projects are described below. To enable readers to appreciate why the various projects were undertaken, within the limits of space, justifications are given with each country-specific project.

Cook Islands

Following a display of interest by a private sector investor in nodule mining for cobalt, nickel and manganese in the EEZ of **Cook Islands**, the Government requested SOPAC urgently prepare a market study on the outlook for cobalt, nickel and manganese, and advise the Government on the implications for nodule mining in their EEZ. A field and market study were undertaken and presentations were made to the Government. Technical SOPAC staff also made themselves available to attend the presentation by the private sector investors to the Government.

In order to expand its economic base, **Cook Islands** are also considering the possibility of developing a pearl aquaculture farming in the Manihiki Lagoon. SOPAC was requested to assist an ADB project to assess the sustainability of such an activity. The project involved the study of tides, currents, water mass properties and bathymetric investigation to better understand water circulation in the lagoon.

The tourism industry, especially on Rarotonga, is one of the largest contributors to GDP in the Cook Islands, consequently the Government is keen to ensure that the industry can be sustained. One of the main fears for tourism is the Cook Islands is that the coastal areas of Rarotonga are vulnerable to natural hazards. Consequently, SOPAC was requested to provide technical advice during the UNDHA-SPPO organised Rarotonga Coastal Tourism Vulnerability Workshop. SOPAC provided expert advice on the types of natural hazards to which the **Cook Islands** in general, and Rarotonga in particular, are most susceptible, and suggested approaches to mapping the effects of those hazards in order to develop appropriate mitigation strategies.

A review of the water resources and supply for Rarotonga was completed by SOPAC staff as part of a field visit .

Maurimai Rakoia sucessfully completed her degree in geology at the University of British Columbia.

The greatest attraction for tourists to cross many oceans to come into the Pacific is still to bask in the sun on white sandy beaches. The sun we still have, the white sandy beaches we are experiencing difficulties in sustaining.

Contrary to widespread public opinion, there are many beautiful and unspoilt beaches on Majuro Atoll. Not many remain however in urban Majuro. The one photographed above occurs on the lagoon side in the Rita area of urban Majuro, Marshall Islands.

Leaving sand on beaches ensures a balanced sediment budget without the gruesome sight of starved beaches. Through tourism this can contribute much towards balancing the national budget of PICs. Removal of sand has been mainly for construction purposes. Alternative sites for mining sand can be found applying the sorts of geoscientific methods that SOPAC specialises in.

Federated States of Micronesia

In need of affordable construction aggregate (sand and gravel), the Pohnpei State of **Federated States of Micronesia** has been licensing mining aggregate resources from Pohnpei Lagoon for a number of years. During the year SOPAC's assistance was sought to develop detailed quality and quantity estimates of the sand resource available in the lagoon, and then to assess the impact of the existing sand mining operations, as they appeared to be causing turbidity and sedimentation that was affecting the coral reefs. As part of this assessment an aerial photography survey of existing sand mining areas, five nearshore dredging operations, and ten selected coastal and offshore aggregate borrow-pit sites in Pohnpei was also carried out.

The problems of coastal erosion in Kosrae arising from coastal developments, especially from the removal of mangroves and the extraction of aggregate for reclamation, particularly during the construction of an airport runway on the reef, are more severe. Consequently SOPAC's assistance was requested to undertake field work to assess the state of the erosion in Kosrae State. Beach profiles, aerial photography, field mapping and ground truthing were completed in order to formulate appropriate response strategies.

Areas of **Federated States of Micronesia**, particularly the State of Pohnpei are experiencing problems with their rural water supply. SOPAC staff completed field investigations to identify the causes of the problems with the rural water supply system in the Paies region and designed a rural water supply system for the village of Nan Mand.

Fiji

Fiji has been experiencing stagnant economic growth since the early 1990's and is searching for ways to increase investment in the country. One area with investment potential is the mineral sector. Consequently, the Government is keen to assist mineral sector investors in their search for minerals.

As **Fiji** already has an established geological survey, with trained professional and technical staff, SOPAC mainly provided assistance through a number of joint initiatives with Fiji's Mineral Resources Department (MRD), whereby MRD provided the logistical support and SOPAC provided technical input and field equipment. Two of the joint projects were related to the search for detrital gold. Two separate areas in Viti Levu were investigated: the Nasivi River delta and Momi Bay area.

To provide mineral sector investors with a clear picture of Fiji's mineral resources, **Fiji** is preparing for the country's first aeromagnetic survey, a project to be funded by AusAID. **Fiji** will be the second country in the region to undertake such a survey, Vanuatu was the first. To ensure that **Fiji** obtains the most from the survey, SOPAC supported the Director of Geology, Mines and Water Resources, **Vanuatu**, to visit **Fiji** to advise on the preparation and best approach to implement the aeromagnetic survey.

As in many other countries in the region, parts of the **Fiji** coastline are threatened by accelerated sea level rise due to climate change. To assess the threat, SOPAC completed vulnerability assessment studies of the capital city of Suva, and the Natadola Bay, an area zoned for future tourist development. The reports contain detailed maps and recommendations for planners and coastal zone managers.

Working in conjunction with the Foundation for the People of the South Pacific, SOPAC staff visited several **Fiji** villages to provide advice on the rural water supply. SOPAC also provided training in the construction of ferro-cement water storage tanks.

The human resource development component of SOPAC's program in **Fiji** involved a training course in the use of the MapInfo computer software. SOPAC also funded a **Fiji** national to attend a workshop on "Hydrothermal activity and its tectonic and Volcanological setting in marginal basins in the Southwest Pacific"; and provided one short attachment to the Regional Data Centre for a Fisheries official to train in trouble-shooting and maintaining networks.

SOPAC, and the Forestry Department of **Fiji** produced the **Fiji** GIS and Remote Sensing Newsletter to provide and exchange information on developments in this field. The Newsletter was circulated to all member countries.

Guam

Guam tends to receive direct technical support from the United States, and the University of Guam, and so submits almost no requests for country-specific assistance from SOPAC. **Guam** has contacts with the other small PICs through its

Top, the recently completed US$2 million seawall at Tafunsak, the main area of population along the north coast of Kosrae, Federated States of Micronesia.

Bottom, manouvering to get the survey boat into the water for the Nasivi River delta detrital gold survey, Fiji.

membership of SOPAC, and receives the benefits of the other programs that operate in the region. It also has access to all of SOPAC's databases.

During the year, SOPAC staff visited **Guam** to assess the management of water issues.

Kiribati

Throughout 1996, SOPAC provided **Kiribati** with a variety of technical services ranging from providing advice on mining and coastal erosion, to assessing the effects of coral blasting and coastal change, and reviewing sanitation and water resource problems on the islands.

Top left, Jackson Lum SOPAC's Minerals Geologist who undertook the desk study re-evaluating the potential for mining the gypsum on Malden Island, Kiribati.

Top right, Kiribati staple food babai is grown in pits which on some atolls are suffering from erosion and saltwater intrusion.

Bottom, Marshallese trainees and SOPAC staff take a break from a mock field exercise set up specifically for the trainees, and used as an opportunity to test equipment in Laucala Bay, Suva.

Thirteen years ago the viability of developing the gypsum resources in the shallow waters of the Malden Island lagoon was assessed. In response to changing market prices, improved extraction technology, and changes in the levels of gypsum availability in the world market, the **Kiribati** Government asked SOPAC to re-evaluate the market potential for mining the gypsum on Malden Island. The desk study concluded that it was still not a viable mining venture, but the updated information database will likely assist future developers.

Kiribati, like many other South Pacific island countries extracts sand from its coastal areas for making cement blocks and for use as aggregate. As part of a long-term monitoring program SOPAC was requested to assess the level of erosion and sedimentation resulting from the extraction of sand in the area adjacent to the Nippon Causeway between Betio and Bairiki in South Tarawa.

The Japanese recently completed the Tungaru Central Hospital, however, soon after completion there were fears that the hospital may be contributing to coastal erosion. JICA then asked SOPAC to assess the impact of the hospital on the coastline so that appropriate mitigation measures, if necessary, could be implemented to stop the coastal erosion. JICA then asked SOPAC to assess coastal erosion issues at sites of possible future Japanese aid projects.

There were two water projects in **Kiribati** during 1996. Firstly, as part of the UNDP project to implement priority water and sanitation activities in participating countries, a report on a field study of the salinity problems with Babai pits (swamp taro growing areas) and water developments on Abaiang, Makin and Butariti, was completed. Secondly, a Sanitation Workshop was organised in **Kiribati**, for the regional countries, with participation from UNICEF, WHO and SPC.

In terms of training and human development, SOPAC conducted a MapInfo training seminar for staff from several government ministries.

Marshall Islands

Aggregate and sand mining form the main non-living resource activity in the **Marshall Islands**. At the request of the **Marshall Islands** Government, SOPAC compiled, into digital form, bathymetric data for Majuro Lagoon to complete a bathymetry map which should assist with the aggregate and sand resource assessment and lagoon circulation studies. SOPAC was also requested to assess the impacts of the aggregate and sand mining on Majuro and to identify alternative development strategies.

The **Marshall Islands** is exploring the potential for developing cobalt rich crusts through deep sea mineral exploration. SOPAC assisted in the planning for the Hakurei-Maru No. 2 cruise which was completed during the year in waters of the **Marshall Islands** - a Japan/SOPAC joint initiative on deep sea mineral exploration.

In conjunction with a UNDP coastal management project for Majuro, SOPAC provided a three-week training program for two nationals and the project manager on coastal zone management at SOPAC, this was primarily intended to strengthen the in-house capabilities of the Marshall Islands Environmental Protection Agency and to improve the decision-making ability of the Majuro Local Government, by upgrading their knowledge on coastal erosion issues.

A strategy and action plan for the Marshall Islands water and sanitation sector was completed.

Niue

The **Niue** economy is small and essentially subsistence-based. While **Niue** attempts to maintain standards of living by encouraging subsistence agriculture, and exporting taro, cyclones have several times obliterated the development efforts made. Consequently, most of SOPAC's work in **Niue** relates to coastal management and geohazard assessment.

In support of the Government's initiative towards developing a comprehensive coastal management program, SOPAC is studying issues related to geological conditions, threats from cyclones and related storm surge, as well as the physical processes in the coastal zone. These SOPAC studies are an essential ingredient for an integrated and effective coastal management strategy.

In 1996, following on from field work completed in late 1995 an initial reconnaissance of geological issues related to coastal development and hazards was completed and a map sheet at a scale of 1:50 000 was produced. This was a first attempt to document shore-zone geology and related coastal management issues on the island.

SOPAC also began preliminary work on a feasibility study on the extension of the main wharf. The Government requested SOPAC to assess the geology and physical oceanographic parameters to ensure that the engineering design of the wharf takes into account the effects of the ocean forces.

Papua New Guinea

Papua New Guinea already has a well-developed minerals and hydrocarbon exploration and extraction program and needs little assistance from SOPAC except in training support which continued through the Certificate in Earth Science and Marine Geology course, the workshop on petroleum licencing held in Port Moresby, and several fellowships for on-the-job training.

In the area of water resource management, SOPAC's role was limited to a review and commentary on the Rural Water and Sanitation Sector Strategy Action Plan.

Solomon Islands

The **Solomon Islands** are keen to identify and develop their mineral resources. A field survey, searching for epithermal gold, to include mapping soil, sediment, rock chip sampling is planned for 1997 in the Hube River propsect, in South Georgia. All background geology work has now been completed, compiled and documented including digitising of the geological maps. A 3-D coloured map of the area was produced indicating a strong resemblance to the Emperor gold system in **Fiji**, however further field work was postponed until 1997, due to a lack of field assistants. When completed, the reports produced from this project are expected to encourage more mineral sector investors to visit and explore the mineral potential of the **Solomon Islands**.

In anticipation of the development of the first gold mine in the **Solomon Islands** (Gold Ridge), SOPAC and USP jointly produced a technical report on a study of hydraulics, sediment chemistry, water quality and the ecology of the Matepono River delta. That information will provide baseline environmental data for use in assessing environmental damage after mining has commenced. In addition, SOPAC was requested to assist in the recruitment of three consultants to assess all aspects of the feasibility study submitted for the mine development at Gold Ridge. Technical support was provided by UNDP.

Tonga

Tonga, is a low lying country which is promoting tourism to assist its economic development. As a low lying country it suffers from the impacts of many natural hazards such as storm surge from cyclones, tsunamis, and coastal inundation which can lead to: flooding of low lying areas, saltwater intrusion of water lenses, agricultural crop and soil damage and coastal infrastructural damage.

To facilitate economic development **Tonga**, like some of the other smaller island nations which face shortages of construction aggregate, has an established beach mining industry. While Government accepts that beach mining is necessary at the present time, it also recognises that beach mining can be environmentally and developmentally damaging. Beach mining removes the first line of natural coastal defence for an island against catastrophic events like cyclones and tsunamis. The result is often major shoreline erosion which can lead to coastal inundation. Obviously any destruction of the coastal areas could generate a downturn in tourism revenues.

To identify the size of the resource available and to minimise the negative impacts of beach mining, Government requested assistance from SOPAC to survey the Vava'u Lagoon for sand resources, and to devise an optimum mining strategy. SOPAC assessed the sand quality and quantity and collected bathymetric and seismic data. A similar study, which assessed beach-mining and beach recovery at a number of key sites in Tongatapu was also completed.

Richard Kautoke successfully completed his surveying degree at Queensland University.

Left, a view of Gold Ridge, the site of Solomon Islands first gold mine.

Right, undercut limestone cliffs along the coast of Alofi, Niue viewed from the top of the cliff at the Niue Hotel.

In geological terms, **Tonga** lies on the Tonga Ridge, a zone of convergence of the Pacific and Indo-Australian tectonic plates. This means that **Tonga** is extremely susceptible to seismicity arising from the movement of these tectonic plates, regional seafloor spreading and localised volcanic activity. Due to the high risk of seismic activity in the Tongan islands, commencement of baseline data compilation was begun with a **Tonga** counterpart for the Nuku'alofa Earthquake Microzoning Project and for a possible Vulnerability Assessment Project for Nuku'alofa.

A visit was made to Tonga to hand over the reports for, and explain the results of, the 1995 Hakurei Maru No.2 cruise in Tonga waters in the southeastern Lau Basin.

The blowholes at Houma along the south coast of Tongatapu, Tonga, a possible site for a pilot project to derive energy from ocean waves.

Tuvalu

All the nine atolls of Tuvalu are particularly vulnerable to coastal erosion. In 1996, SOPAC completed field work including aerial photo interpretation to assess the impact of coastal erosion on the small and low-lying islands of Vaitupu, Nukufetau and Amatuku (Funafuti Atoll).

Tuvalu frequently suffers from water shortages. To remedy this situation SOPAC staff visited **Tuvalu** and prepared a project proposal to construct underground rainwater storage. If this project proposal is successful, construction is expected to commence in 1998.

Fano Patolo successfully completed his degree in Land Management at USP.

Vanuatu

Vanuatu has long been recognised as having mineral potential, but as yet no mines have been established. Despite this the Government is keen to see the mineral sector developed and so has made various requests to SOPAC for assistance in this field.

Assistance was provided to establish a national mineral resources database (in collaboration with the British Geological Survey) that can store mineral survey data. It is anticipated that this database will serve as a model for other member countries with similar needs.

In order to increase in-house capability in the area of mining, the Department of Geology, Mines, and Water Resources organised a seminar on mineral economics and mineral taxation. The experiences of other mining countries in the region, namely **Fiji**, **Papua New Guinea** and **Solomon Islands**, were presented by SOPAC.

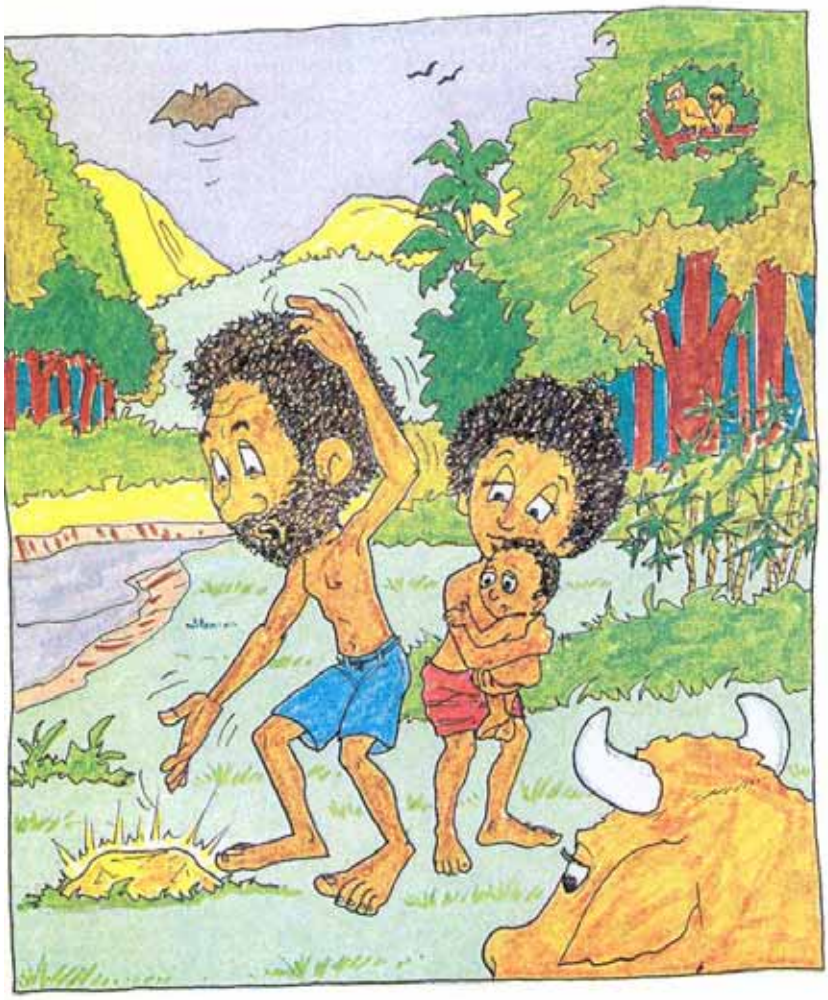
Also in anticipation of growth in Vanuatu's mineral sector, the SOPAC Hydrogeologist assisted in formulating a project for baseline hydrological studies in potential mining areas which could be used in later assessment of the possible water supply pollution implications following mine development.

SOPAC's contribution to human resource development included training a database officer in network administration and MapINFO.

Western Samoa

Despite the high rainfall and the abundant streams and waterfalls, **Western Samoa** frequently suffers from water shortages, mainly from poor water catchment management. To resolve some of the water problems, the Europan Union requested SOPAC to undertake a National Water Resources Master Plan Study (Stage 1). The Study was prepared by consultants, but reviewed by SOPAC and in 1996, the final draft was submitted to the Western Samoa Water Authority.

SOPAC also reviewed and commented on contract documents for the construction of two major rural water supply schemes for the Western Samoa Water Authority, and on the Rural Water Supply Master Plan.



The increase in mineral exploration activities in Vanuatu will have its associated problems. Vanuatu's Department of Geology, Mines and Water Resources requested assistance for special awareness publications in Bislama to help educate customary land owners about their rights and privileges and the rights and privileges of prospectors speculating on their land. Three cartoon books are expected to be released mid-1997.

Secretariat Support Services

In order to maintain the range of technical services to the member countries, the SOPAC Secretariat must provide a variety of other support services, these include: collating and disseminating information to its member countries, providing other information services, as well as providing field staff and technical support for projects. All of these activities are less glamorous than some of the other aspects of SOPAC's work, but all are vital and essential to the continued success of the activities of the organisation, therefore continued donor support of these services is critical to ensure that country specific projects can be successfully implemented.

Regional Data Centre

The isolated nature of the South Pacific island countries coupled with generally poor communication links between the various Pacific island states have hampered the development of the region for many years. To improve the level of regional communication, the Regional Data Centre has been actively involved in the establishment of a gateway for full Internet services for the region. It has been using **Fiji** as its testing ground, to identify the most cost-effective Internet service. Ultimately, the **Fiji** example is expected to be used as a model for the region.

An important aid to improved communication systems between SOPAC and the member countries was the provision of a PEACESAT 3-metre terminal under United States funding in late 1995. SOPAC used PEACESAT to organise monthly conferences to discuss SOPAC's work program with member countries, and to provide cheaper remote-access to voice and data systems within SOPAC. Member countries use of this facility is still at an early stage of development.

Yautalei, *the Fiji Mineral Resources Department vessel jointly maintained with the Field Support Services staff at the SOPAC Secretariat. Most coastal geophysical surveys carried out by the SOPAC coastal team are carried out using this size and type of vessel.*

The focus of the Regional Data Centre in 1996 was on maintaining the standards developed under the European Union funded SOPACMAPS data distribution project, and on providing hardware and software upgrades for those member countries with CD-ROM readers.

A Regional Information Technology Strategies meeting was held amongst the regional organisations to determine a consistent set of strategies to benefit all member countries. In line with these strategies, SOPAC continued to upgrade its Regional Data Centre to enable it to provide the best service to member countries. Also during 1996, it provided computer equipment and software, and/or software upgrades to member countries, including: **Fiji**, **Kiribati**, **Papua New Guinea**, **Solomon Islands**, **Tonga**, **Tuvalu**, **Vanuatu** and **Western Samoa**. As a backup to this, the Regional Data Centre provides a constantly monitored 'help desk' to provide advice and assistance on system, and software problems.

Information Services

SOPAC's well-respected library is continually updated and refreshed to ensure that the information and services it provides (including interlibrary loan, reference and reader service) are world class.

The Information Services section reviews and edits all of SOPAC's technical reports. In 1996, 49 internally-produced reports related to activities that occurred in member countries, or about member countries were published (refer Appendix 1). It also prepared and published three issues of *SOPAC News*, two issues of *SOPAC Projects*, The *Annual Report Summary*, *Proceedings of the Annual Session*, and two issues of the *GIS & Remote Sensing News*. Two glossy magazines; *Coasts of Pacific Islands* and *Ocean Wave Energy in the South Pacific* were produced, and final work on two other major publications was undertaken. The publications service provided through Information Services is available to all member countries free of charge, although at present this service is not fully utilised by many countries.

Information Services maintain the SOPAC bibliographic database through the Pacific Islands Marine Resources System (PIMRIS), and the NAMES database.

Drafting services, also come under the ambit of Information Services, and provide SOPAC with all its necessary maps and materials for presentations during the year. In 1996, four coastal maps, one regional map, and one bathymetric map were prepared (Appendix 1). All the drafting services are available to all member countries.

Field Support Services

The Field Support Services section, largely funded by the European Union and Australia plays a vital role by providing logistical and equipment support for all field work carried out by SOPAC throughout the region. The equipment, which needs to be maintained to a high standard to ensure reliability and accuracy, consumed much of this sections time during the year. Equally vital was a time-consuming aspect of Field Support Services work which was the preparation for laboratory analysis of all soil, sand and rock samples taken during the field trips. This pre-analysis work on samples involves various combinations of drying, crushing, sieving and sorting that can stretch into several weeks due to the large number of samples and meticulous procedure that is required for such preparation.

Maintenance work is carried out through the Electronics Workshop and the Mechanical Workshop. The Electronics Workshop assists the staff in the Regional Data Centre repair and maintain computer hardware, network cabling and the PEACESAT terminal. The Mechanical Workshop maintains all the small engines, generators, water pumps and winches. It also fabricates specialist equipment for field surveys.

The workshop staff mobilised equipment for ten surveys and assisted in all field trips. the field trips were in **Fiji** (Suva, Nasivi River Delta and Momi Bay), **Federated States of Micronesia** (Pohnpei), **Marshall Islands** (Majuro Lagoon), and **Tonga** (Vava'u).

Equipment acquired in 1996 included a survey boat, the Yautalei, this was used for three surveys, and training of students in the Certificate of Earth Science course. It has also been used for sea trials of new equipment. A Yanmar Water Pump was also purchased.

Management and Corporate Services

1996 proved to be a year of considerable upheaval at SOPAC, and was also a time when two of SOPAC's major donors, the European Union and **Australia**, completed major reviews.

The European Union review, completed earlier in the year, entitled "Evaluation of the SOPAC-Component of the Pacific Regional Marine Resources Development Program (PRMRDP)" assessed the economic benefits of SOPAC's implementation of the PRMRD Program funded through Lomé III. The report focussed on the PRMRDP, a wide-ranging program, that essentially covers the role of SOPAC, its impact, the sustainability of its programs, and its cost-effectiveness.

A more significant event for Management and Corporate Services was the mid-year review by **Australia**. The Australian review called for debate on the benefits of SOPAC's continuance, and indicated that, if all member countries agreed, SOPAC's budget should be substantially reduced, at least until its activities were more thoroughly reviewed. The Australian position forced the member countries to consider how SOPAC assists each of them and what its core functions should be.

David Tappin, chief architect of the European Union review report is a geologist with the British Geological Survey.

The Australian review was submitted for discussion at the 25th Annual Session held in Rarotonga in October 1996. At the Annual Session, the member countries came out strongly in favour of maintaining SOPAC. However, it was agreed that a Sub-committee of Council members should be formed to discuss the future role and direction of SOPAC, more specifically the organisational structure and the remuneration of SOPAC staff. This Sub-committe completed its work, and reported to Council members in December.

The debate sparked by the Australian review taught SOPAC a valuable lesson, namely, that it needs to 'sell itself'. Island member countries need to be very clear about the economic benefits arising from their participation in SOPAC. Donors should also have a clearer understanding of how their money is being spent.

Consequently, SOPAC's management had to spend a considerable portion of the second half of the year justifying SOPAC's prioritisation of its work program, the management structure, the financial remuneration of its staff, its core activities, and defining and redefining SOPAC's future role.

Representatives of donor and supporting governments and agencies at the 25th SOPAC Session held in Rarotonga, Cook Islands in October 1996.

In addition to responding to the two reviews, SOPAC management undertook their yearly tasks of visiting member countries, fund raising and liaison with other regional and international organisations. In order to foster closer ties with other organisations, to ensure that all agencies were working towards the same goals, SOPAC collaborated with the Intergovernmental Oceanographic Commission of UNESCO, particularly the sub commission for the Western Pacific, the International Hydrological Program of UNESCO, the European Union, the United Nations Environment Program, the United Nations Conference on Trade and Development, Sea Grant/PIN, the Metal Mining Agency of Japan, the Japan Marine Science and Technology Centre, the Korean Ocean Research and Development Institute, the British Geological Survey, the Commonwealth Secretariat, IFREMER and ORSTOM, the National Oceanographic and Atmospheric Administration (US), and the APEC-MRC Working Group.

Finance

Total cash funding to SOPAC in 1996 was just over F$4.9 million (Appendix 3), F$0.5 million greater than in 1995, largely due to increased extra-budgetary contributions from donors and through a surplus in the general funds balance in 1996. Voluntary grants from **New Caledonia**, **French Polynesia** and a special grant from **Fiji** provided additional funding towards SOPAC's core 1996 budget.

Total cash expenditure was F$3.7 million, an increase of F$0.1 million over 1995.

Funding and Donor Support

Australia's total grant to SOPAC reverted back to A$720,000 for 1996, after a reduction of A$60,000 in 1995. **New Zealand**'s 1996 funding remained at the 1995 level of NZ$425,000, however, **New Zealand** also accounced an additional NZ$75,000 for 1997.

Canadian funding to SOPAC, under CSPOD I, continued to diminish as the four remaining projects neared their concluding stages; the two coastal and minerals programs will formally conclude mid-1997, while the remaining two will conclude in June and December of 1998.

All the European Union funding, through Lome III, will expire by the end of 1997, however SOPAC during 1996 submitted proposals to the European Union for consideration under Lomé IV funding, such as the project entitled 'Environmental Management and Sustainable Development of Mineral Resources'. This project was approved as a standby project in 1993, and was reconfirmed in early 1996 by the Pacific ACP ministers.

France continued to offer support to SOPAC in 1996, both through French Government funding of staff positions, and through in-kind support from the French organisations IFREMER and ORSTOM. However, at the Annual Session, France allied itself with the Australian Government and noted that it too would withhold additional funding until the sub-committee to review SOPAC's future direction had met.

The United Nations, through UNDP, UNEP, and UNESCO were the leading donor agencies to SOPAC's Water and Sanitation Program in 1996. The current program is coming to an end in 1996, and to ensure continued support for it, SOPAC has been involved in developing regional funding commitments. Once again, the UNDP has been targeted specifically to assist this area of SOPAC's work.

Funding through the Commonwealth Secretariat was directed mainly at support for the Earth Science and Marine Geology Training Course, and the Coastal Aggregate Geologist.

China, Japan, USA, the UK and the Asian Development Bank all continued to support SOPAC either directly through the provision of funds or through in-kind support.

As a donor supported organisation, SOPAC Management and Corporate Services undertook the full time job of submitting funding proposals, for on-going projects as well as for new projects. During 1996, project proposals were submitted to France, China, Japan, UNDP, Commonwealth Secretariat, Sasakawa Foundation, EU (Lomé IV), CIDA (CSPOD II), and Asian Development Bank. SOPAC tried to attract funding for a regional geothermal investigation program to establish a regional geothermal database. Unfortunately funding did not materialise.

Appendices

Appendix 1: Completed Reports and Publications for 1996

PUBLICATIONS

Annual Report Summary 1995.

Proceedings of the Twenty-fifth Session, Rarotonga, **Cook Islands**, 2-8 October 1996.

Sherwood, A., Howorth, R. (eds) 1996. Coasts of Pacific Islands. SOPAC Miscellaneous Report 222.

Barstow, S.F., Falnes, J. 1996. Ocean Wave Energy in the South Pacific - the resource and its utilisation. SOPAC Miscellaneous Report 234.

SOPAC News: 3 issues

SOPAC Projects: 2 issues

REPORTS

Technical Reports

Xue, C. 1996. Coastal sedimentation, erosion and management of Kosrae, **Federated States of Micronesia**. SOPAC Technical Report 228.

Mourits, L.J. 1996. An assessment of saltwater intrusion in Babai pits and some water supply projects on Makin, Butaritari and Abaiang, Republic of **Kiribati**. SOPAC Technical Report 229.

Mogensen, U. 1996. Engineering report for Paies Water Supply System, Kitti Municipality, Section I, Pohnpei. SOPAC Technical Report 230.

Pratt, C., Lum, J., Smith, R. & others, 1996. Detrital gold resources survey, Nasivi River Delta, Tavua, **Fiji**, 5 November - 15 December 1995. SOPAC Technical Report 231.

Hosoi, Y. 1996. Executive Summary. Report on the Cooperative Study Project on the Deepsea Mineral Resources in selected offshore areas of the SOPAC Region, Volume 1, Phase III: Sea Area of the Kingdom of **Tonga**. SOPAC Technical Report 232.

Forbes, D.L. 1996. Coastal geology and hazards of **Niue** Island, South Pacific Ocean. SOPAC Technical Report 233.

Xue, C. 1996. Coastal erosion and management of Amatuku Island, Funafuti Atoll, **Tuvalu**. SOPAC Technical Report 234.

Forbes, D.L., Biribo, N. 1996. Shore-zone sand and gravel resources of South Tarawa, **Kiribati**: preliminary assessment of selected sites. SOPAC Technical Report 235.

Doig, K. 1996. Republic of **Marshall Islands** Water and Sanitation Sector, Strategy and Action Plan. SOPAC Technical Report 236.

Smith, R., Kitekei'aho, T. 1996. Lagoonal sand and gravel resources, Vava'u, **Tonga**. SOPAC Technical Report 237.

Xue, C. 1996. Coastal sedimentation, erosion and management of southwest Nukufetau atoll, **Tuvalu**. SOPAC Technical Report 238.

Yeo, G., Lum, J., Mahoa, H., Molia, T. 1996. Report on a baseline study of hydraulics, sediment chemistry, water quality, and ecology of the Matepono River delta, Guadalcanal, **Solomon Islands**. SOPAC Technical Report 239.

Lum, J. 1996. Desk study on the re-evaluation of the potential of gypsum deposit on Malden Island, **Kiribati**. SOPAC Technical Report 240.

Mogensen, U. 1996. Engineering report for Nan Mand Water Supply System, Kitti Municipality, Section II, Pohnpei, **Federated States of Micronesia**. SOPAC Technical Report 241.

Solomon, S., Kruger, J. 1996. Vulnerability and adaptation assessment, coastal impact of sea-level change, Suva and vicinity, Viti Levu, **Fiji** Islands. SOPAC Technical Report 242.

Cruise Report

Taylor, B. 1996. R/V Moana Wave 9603 preliminary cruise report, 10 March 1996 - rifting, oblique spreading, and an extensional transform zone, in the Lau backarc Basin. SOPAC Cruise Report 145.

Tappin, D. 1996. Site survey cruise on RV Melville: Boomerang Leg 8, May-June 1996. SOPAC Cruise Report 146.

Preliminary Reports

Pratt, C., Lum, J., Smith, R. 1996. Detrital gold resources survey, Nasivi River Delta, Tavua, **Fiji**, 5 November to 15 December 1995. SOPAC Preliminary Report 84.

Smith, R., Kitekei'aho, T., Young, S. 1996. Lagoon sand and gravel resources investigations, Vava'u, **Tonga**. SOPAC Preliminary Report 85.

Woodward, P., Shorten, G. 1996. Airphoto survey of coastal areas, Pohnpei, **Federated States of Micronesia**. SOPAC Preliminary Report 86.

Solomon, S. 1996. Physical oceanography and analysis of lagoon circulation and flushing, Manihiki, Northern **Cook Islands**. SOPAC Preliminary Report 87.

Miscellaneous Reports

Martin, F. 1996. Internet for non-commercial organisations. Study and implementation plan. SOPAC Miscellaneous Report 218.

Burke, E. 1996. UNEP Caribbean Workshop on Alternative Freshwater Augmentation Technologies, 24-27 October 1995. SOPAC Miscellaneous Report 219.

Martin, F. 1996. Internet for non-commercial organisations - application. SOPAC Miscellaneous Report 220.

Lum, J. 1996. Outlook for cobalt, nickel and manganese - implications for manganese nodule mining. SOPAC Miscellaneous Report 221.

Burke, E. 1996. Final report on the Workshop on technologies for maximising and augmenting freshwater resources in small islands (South Pacific, Indian Ocean and South China Sea region). SOPAC Miscellaneous Report 223.

Depledge, D. 1996. Workshop on analytical techniques for low-level nutrients in the sea; and planning for quality control of analytical data for the South Pacific region (held at the School of Pure and Applied Sciences, University of the South Pacific, Suva, Fiji) 2-16 February 1996. SOPAC Miscellaneous Report 224.

Allinson, L. 1996. Recommendations for upgrade of the Information System, Lands and Survey Department and Fisheries Department , Ministry of Natural Resources, Funafuti, **Tuvalu**. SOPAC Miscellaneous Report 225.

Allinson, L. 1996. ITPACNet 96: Regional Information Technology - Strategies Meeting 1996, South Pacific Commission, Noumea, **New Caledonia**, 24-26 April 1996. SOPAC Miscellaneous Report 226.

Boyes, G., Larue, M. 1996. The South Pacific and Article 76 of the Law of the Sea. SOPAC Miscellaneous Report 227.

Williot, F., Larue, M. 1996. GeoConverter 1.0. SOPAC Miscellaneous Report 228.

Depledge, D. 1996. Water resources development and management in the Pacific Region, issues and opportunities. [Keynote presentation Session VI: Regional consultation workshop, Asian Development Bank, Manila, 10-14 May 1996]. SOPAC Miscellaneous Report 229.

Howorth, R. 1996. Regional context for Commonwealth Fund for Technical Cooperation (CFTC). SOPAC Miscellaneous Report 230.

Burke, E. 1996. PWA Steering Committee Meeting. SOPAC Miscellaneous Report 231.

Howorth, R. 1996. SOPAC and its role in coastal development and related national capacity building for Pacific Island countries. SOPAC Miscellaneous Report 232.

Accascina, G. 1996. National connectivity for development organisations using the SOPAC Hub. SOPAC Miscellaneous Report 233.

Burke, E. 1996. Pacific Water Association, 1996 Inaugural Meeting, Pago Pago, American Samoa, 22-24 August 1996. SOPAC Miscellaneous Report 235.

Solomon, S. 1996. The use of remote sensing data in assessment of shore protection needs and effects in the South Pacific. SOPAC Miscellaneous Report 236.

Crook, K.A.W., Howorth, R. 1996. Abstracts of papers presented at the STAR Session 1996. SOPAC Miscellaneous Report 237.

Depledge, D. 1996. SOPAC Workshop on Appropriate and Affordable Sanitation for Small Islands, Tarawa, Republic of **Kiribati**, 6-8 August 1996. SOPAC Miscellaneous Report 238.

Howorth, R. 1996. SOPAC's Geohazards Program. Activities over the past year and planned activities for the coming year. (Prepared for the 5th IDNDR Regional Disaster Managers Meeting, Nuku'alofa, **Tonga**, 16-20 September 1996). SOPAC Miscellaneous Report 239.

Report of the SOPAC Sub-Committee on the future role and direction. SOPAC Miscellaneous Report 240.

Kruger, J. 1996. Beaches on the southwest shoreline of Suva Peninsula, Viti Levu, **Fiji** Islands. SOPAC Miscellaneous Report 241.

Training Reports

Elaise, A. 1996. Report on the Basic Course for the Certificate in Earth Science and Marine Geology Training Program, 1996. SOPAC Miscellaneous Report 72.

Howorth, R. 1996. Brief report on a four-day basic geology refresher course for technical staff of the Water and Mineral Resources Division, Solomon Islands. SOPAC Training Report 73.

Joint Contributions

Mogensen, U. 1996. Technologies for augmenting freshwater resources in small island developing states – Source Book for Managers and Planners. UNEP/SOPAC Joint Contribution 112.

Japan International Cooperation Agency, Metal Mining Agency of Japan 1996. Report on the cooperative study project on the deepsea mineral resources in selected offshore areas of the SOPAC region (volume 1) sea area of the Kingdom of **Tonga**. JICA, MMAJ, [s.l.]: 129 p.; figs.; tables. SOPAC Joint Contribution 113. (10 volumes, including video cassettes and recording rolls).

MAPS

SOPAC Coastal Map Series

1. Map 6: Coastal Morphology of **Tuvalu** - Funafuti (Scale 1:2500)
2. Map 7: Coastal Morphology of **Niue** (Scale 1:50 000)
3. Map 8. Coastal Geology of **Tuvalu** - Southwest Nukufetau (Scale 1:5000)
4. Map 9. Coastal Geology of **Tuvalu** - Vaitupu (Scale 1:10 000)

SOPAC Region

1. South Pacific Maritime Limits Map. Scale 1cm = 140 km at 0°

SOPAC Bathymetric Map Series

1. Map 30: Bathymetric Map of **Western Samoa** - Apia Harbour (Scale 1:3000)

OTHERS

GIS & Remote Sensing Newsletter: 2 issues

28 Trip reports

Appendix 2: Secretariat Staff List (as at 31 December 1996)

SECTIONS	NAME	COUNTRY OF ORIGIN	DATE JOINED	CONTRACT START	CONTRACT END
MINERALS					
1 Marine Geologist	Robert Smith	Australia	Oct 88	Jul 92	Jun 97
2 Marine Geologist	Jackson Lum	Fiji	Nov 92	Nov 92	Nov 98
3 Chief Cartographer	Phil Woodward	Australia	Aug 88	Aug 94	Jul 97
4 Program Assistant	Litia Waradi	Fiji	Apr 89	Jan 91	Permanent
5 Offshore Geologist	Takeshi Ogitsu	Japan	Oct 96	Oct 96	Oct 97
HYDROCARBONS					
6 Petroleum Coordinator	vacant				
7 Petroleum Geophysicist	vacant				
COASTAL MANAGEMENT & GEOHAZARDS					
8 Coastal Geologist	Steve Solomon	Canada	April 96	April 96	April 97
9 Coastal Geologist	Xue Chunting	China	Sept 94	Sept 94	Sept 96
10 Aggregate Geologist	Graham Shorten	Australia	Oct 95	Oct 95	Oct 97
COASTAL MAPPING					
11 Mapping Geologist	vacant				
12 Computer Geologist	Benjamin Romain	France	Sept 96	Sept 96	Sept 97
13 Computer Operator	Bougainville Toloi	Fiji	Jan 88	Permanent	
OFFSHORE MAPPING					
14 Offshore Coordinator	vacant				
WATER RESOURCES					
15 Project Manager	Ed Burke	New Zealand	Dec 94	Dec 94	Nov 96
16 Hydrogeologist	vacant				
17 Associate Expert/Engineer	Giovanni Ricci	Italy	Nov 96	Nov 96	Nov 97
18 Program Assistant	Aliti Sema	Fiji	Jan 95	Jan 95	Dec 96
HUMAN RESOURCE DEVELOPMENT					
19 Training Coordinator	Russell Howorth	New Zealand	Oct 86 *	July 92	Jul 97
20 A/Training Coordinator	vacant				
21 Program Assistant	Anna Elaise	Fiji	Jul 90	Nov 90	Permanent
REGIONAL DATA CENTRE					
22 Information Tech. Manager	Les Allinson	Australia	Nov 92	Nov 95	Nov 98
INFORMATION SERVICES					
23 Publications Coordinator	Mereseini Bukarau	Fiji	Nov 85	Sept 96	Sept 99
24 Librarian	vacant				
25 Program Asst/Librarian	Sunita Prasad	Fiji	May 89	Jan 91	Permanent
26 Info/Publications Asst.	Laisa Baravilala	Fiji	Jul 87	Permanent	
FIELD SUPPORT SERVICES					
27 Senior Electronics Technician	Simon Young	Fiji	Jan 93	Jan 93	Jan 97
28 Electronics Technician	Peni Musunamasi	Fiji	Jun 89	July 92	Permanent
29 Marine Mechanic	Joe Mausio	Fiji	Mar 89	Mar 89	Permanent
30 Workshop Assistant	Setareki Ratu	Fiji	Oct 86	Permanent	
31 Technical Support Asst.	Graeme Frost	Fiji	Mar 92	Mar 92	Permanent
32 Senior Geology Technician	Sekove Motuiwaca	Fiji	Apr 80	July 92	Permanent
MANAGEMENT					
33 Director	Philipp Muller	W/Samoa	Jan 92	Jan 95	Jan 98
34 Deputy Director	Alfred Simpson	Fiji	Feb 95	Feb 95	Jan 98
35 Fin & Admin Controller	Umar Farook	Fiji	Apr 91	Apr 94	Apr 97
36 Personal/Travel Assistant	Lavenia Kamali	Fiji	Mar 89	Mar 89	Permanent
FINANCE & ADMINISTRATION					
37 Accountant	Mohinish Kumar	Fiji	Mar 95	Mar 95	Mar 98
38 Administrative Assistant	Nazmeen Whippy	Fiji	Jul 86	Permanent	
39 Assistant Accountant	Atesh Narayan	Fiji	Jan 93	Permanent	
40 Secretary/Clerk	Annette Olssen	Fiji	Oct 90	Permanent	
41 Registry Clerk	vacant				
42 Receptionist/Clerk	Unaisi Bainiloga	Fiji	Feb 87	Permanent	
43 Driver/Clerk	Enele Gaunavou	Fiji	Jul 88	Permanent	
44 Office Assistant Cleaner	Niu Daurewa	Fiji	Sep 87	Permanent	
PROGRAM COORDINATION					
45 Special Fund Coordinator	vacant				

Appendix 3: 1996 Revised Budget and 1997 Approved Budget

1996 Revised Budget & 1997 Approved Budget

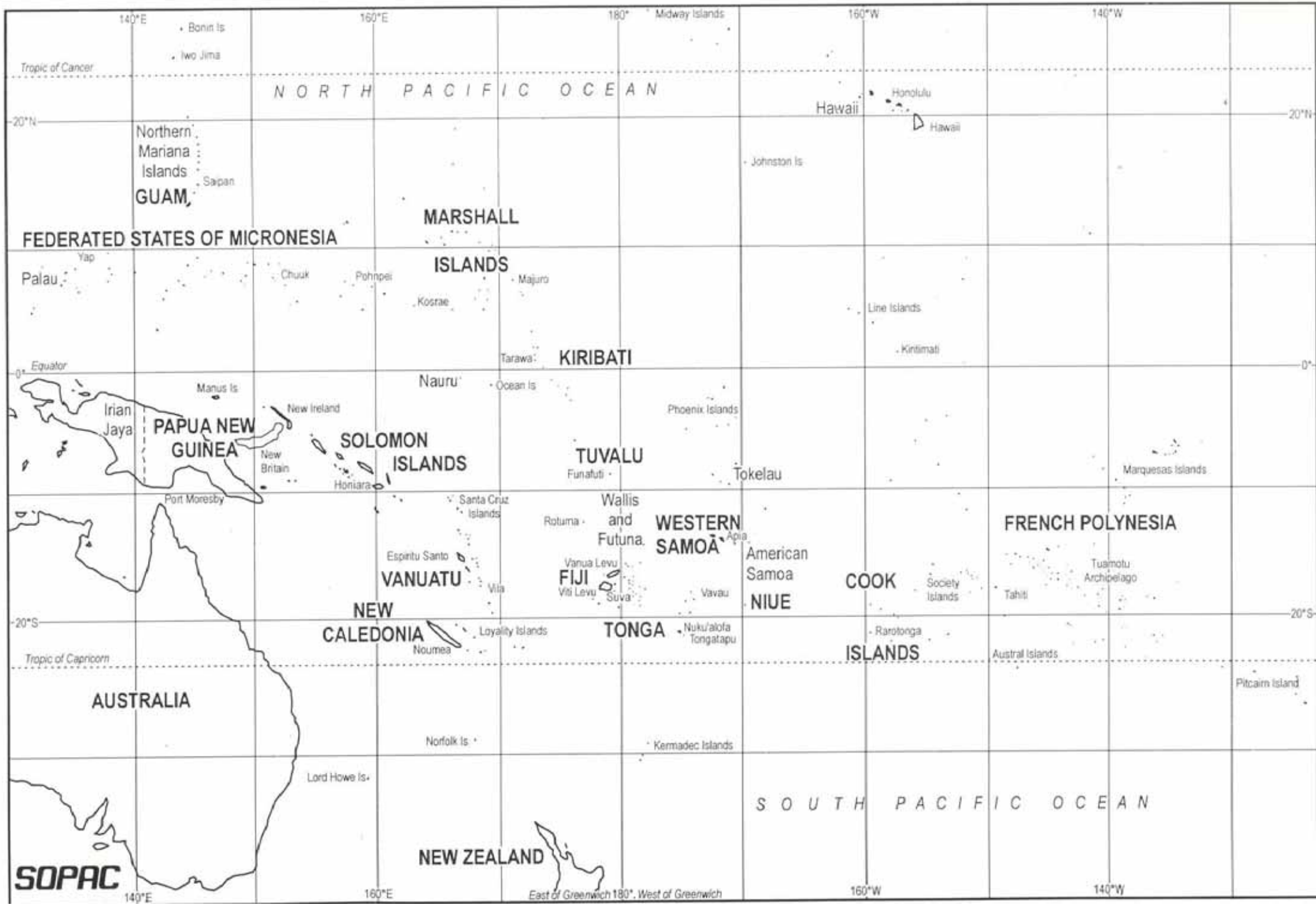
SUMMARY OF ANTICIPATED INCOME (INCLUDING IN-KIND SUPPORT CONTRIBUTION) AND EXPENDITURE BY PROGRAMS

	1996 REVISED BUDGET F$	1997 APPROVED BUDGET F$
PROGRAM HEADS		
Minerals and Energy Resources	692,100	673,000
Environmental Geoscience	1,770,200	1,318,000
Capacity Building	567,000	459,500
Technical Services	699,376	834,200
Corporate Services	1,187,500	1,014,000
TOTAL	**4,916,196**	**4,298,700**

Appendix 4: Glossary of Technical Terms

Aeromagnetic survey	:	A survey undertaken from an aircraft to measure the intensity of the earth's magnetic field; looking for distortions in the field which indicate the presence of anomalies and point to possible areas of mineral occurrence.
Aggregate borrow-pit sites	:	Usually undeveloped areas of land, or reef sites where aggregate for construction purposes is removed.
Bathymetry	:	The shape of the seafloor.
Cobalt-rich crusts	:	Rock surfaces that are coated with manganese deposits enriched with the metal cobalt.
Detrital/placer gold	:	Gold found on the surface of the ground, generally formed by the weathering of rocks, and transported to another area by natural processes.
EEZ	:	Exclusive Economic Zone; a term created by the United Nations Convention on the Law of the Sea which gives states the right to claim 12 nautical miles of territorial waters, and a 200 nautical mile zone around their coastline.
Epithermal gold	:	Gold found at shallow depths formed by the flow of low temperature, low pressure hydrothermal solutions through rocks.
Ground truthing	:	Obtaining data on the ground to aid in the interpretation of anomalies seen in remote-sensed data.
Hydrothermal minerals	:	Minerals found onshore and offshore, both on the surface and underground, formed by the passage of hot aqueous rich solutions through rocks.
Nodule mining	:	Commonly refers to the future mining of manganese rich nodules from the ocean floor.
Regional minerals database	:	A database of the geology, the sampling locations, and the occurrence of the most common metallic minerals, such as, gold and copper, found in SOPAC member countries.
Remote images	:	Any photo image taken from a camera usually on either an aircraft or a satellite.
Remote sensing	:	The technique of acquiring geological information without actually collecting samples on drilling holes.
Seismic data	:	Cross-section images of the Earth produced by recording reflected or refracted waves from an energy source like an explosion, earthquake or a tuned-sound transducer.
Synthetic aperture radar	:	produces remote images of the earth produced by radar usually on aircraft. Differs from optical images in that SAR can see through clouds.
Technical backstopping	:	Provision of technical advice on request, for example, reviewing technical reports from other agencies/ donors.

Map of the Region & SOPAC Member Countries



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