Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources (STAR)

Fourth Session

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In this Series, entitled

Reports of Meetings of Experts and Equivalent Bodies, which was initiated in 1984 and which is published in English only, unless otherwise specified, the reports of the following meetings have already been issued:

1. Third Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
2. Fourth Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
3. Fourth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of «El Niño» *(Also printed in Spanish)*
4. First Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in relation to Living Resources
5. First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in relation to Non-Living Resources
6. First Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
7. First Session of the Joint CCOP (SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
8. First Session of the IODE Group of Experts on Marine Information Management
9. Tenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Tectonics and Resources
10. Sixth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
11. First Session of the IOC Consultative Group on Ocean Mapping *(Also printed in French and Spanish)*
12. Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ships-of-Opportunity Programmes
13. Second Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
14. Third Session of the Group of Experts on Format Development
15. Eleventh Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
16. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
17. Seventh Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
18. Second Session of the IOC Group of Experts on Effects of Pollutants
19. Primera Reunión del Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y Parte del Océano Pacífico frente a Centroamérica *(Spanish only)*
20. Third Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
21. Twelfth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
22. Second Session of the IODE Group of Experts on Marine Information Management
23. First Session of the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific
24. Second Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in relation to Non-Living Resources *(Also printed in French and Spanish)*
25. Third Session of the IOC Group of Experts on Effects of Pollutants
26. Eighth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
27. Eleventh Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans *(Also printed in French)*
28. Second Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
29. First Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
30. First Session of the IOCARIBE Group of Experts on Recruitment in Tropical Coastal Demersal Communities *(Also printed in Spanish)*
31. Second IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
32. Thirteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asia Tectonics and Resources
33. Second Session of the IOC Task Team on the Global Sea-Level Observing System
34. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
35. Fourth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
36. First Consultative Meetings on RNODCs and Climate Data Services
37. Second Joint IOC-WMO Meeting of Experts on IGOSS-IODE Data Flow

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1. OPENING OF THE SESSION

The Chairman, Dr. Charles Helsley, called the Fourth Session of the Joint CCOP/SOPAC - IOC Working Group on South Pacific Tectonics and Resources (STAR-IV) to order at 1400 hours on Friday, 14 October 1988, in the Conference Room of the Scotts Hotel, Suva, Fiji. He welcomed the Delegates and Observers from Member Countries of CCOP/SOPAC and Member States of IOC, as well as Representatives of UN Agencies and Observers from regional project groups (the List of Participants is given in Annex III).

The Chairman reminded the Joint Working Group that STAR is a body that has two parents: IOC and CCOP/SOPAC. As such, the responsibility of the Joint Working Group is to formulate and assist in the implementation of a scientific research programme under the general guidelines of IOC and CCOP/SOPAC, addressing the needs of the SOPAC region. The Chairman also stressed the need for close interaction between SOPAC member countries and scientists interested in the region in the formulation of these plans.

The Assistant Secretary of the IOC, Dr. Kazuhiro Kitazawa, acting as the Technical Secretary for the Session, welcomed participants on behalf of the Secretary of IOC and thanked the Government of Fiji for hosting the Session.

2. ADOPTION OF THE AGENDA

The Chairman introduced the Provisional Agenda. The Joint Working Group, after agreeing to some amendments, adopted the Agenda (Annex I).

Dr. Keith Crook, Australian National University (ANU) was appointed as Rapporteur for the Session.

The Chairman introduced the Provisional Timetable. Reflecting the spirit of the Recommendation STAR-III.7 in which the Working Group recommended that a session devoted to the presentation and discussion of recent scientific results be added to the programme of its future sessions, the Chairman proposed that Agenda item 6 should be emphasized.

3. INTERSESSIONAL ACTIVITIES

3.1 INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

The Assistant Secretary of IOC, Dr. K. Kitazawa, informed the Working Group that the Second Session of the IOC-UN Guiding Group of Experts on the Programme of Ocean Science in relation to Non-Living Resources (OSNLR II) was held at IOC, Paris, France, from 26 to 30 January 1987. In accordance with the request made at the Second

Session of STAR, Dr. C. Helsley was invited to the OSNLR [1] Session in his capacity as Chairman of STAR. At this meeting he presented the activities of STAR and urged greater recognition of the needs and goals of the SOPAC region. The Guiding Group noted with satisfaction the current activities carried out by STAR and recommended that IOC consider developing in the WESTPAC region two sub-regional components of OSNLR. One through CCOP-IOC Joint Working Group on Post IDOE Studies of East Asian Tectonics and Resources (SEATAR) would address problems related to marginal basins near the Asian continent; the other, through, STAR would address problems of regional interest to the South Pacific region.

The Assistant Secretary also informed the Working Group that, following the recommendation made at the Fourth Session of the IOC Regional Committee for the Western Pacific (WESTPAC) held in Bangkok, Thailand, from 22 to 26 June 1987, a workshop on marine geology and geophysics in WESTPAC was convened in conjunction with the First International Conference of Asian Marine Geologists, in Shanghai, China, 9-10 September 1988. The Workshop proposed the following projects for regional co-operative research in the WESTPAC region:

(i) Sedimentology in the Gulf of Thailand;

(ii) Quarternary Palaeogeography and Seismic Stratigraphy of Continental Shelves of the Yellow-Sea and East China Sea, Sea of Japan;

(iii) Palaeo-oceanography of the Northern Pacific Ocean during the Late Pleistocene;

(iv) Changing Sea Levels and their Effects on the Coastal Resources of Thailand;

(v) Late Pleistocene Palaeogeographic Maps of WESTPAC Region;

(vi) Quarternary Palaeographic Maps of the WESTPAC Region;

(vii) Tectonic Process of Back-arc Basin Obduction

(viii) Mass-flow Deposits on the Continental Slopes of the Sea of Japan and East China Seas;

(ix) Boundary Processes along the Fore-arc Sliver;

(x) Tectonic Nature of Transition from the Southwestern Sub-basin to the Eastern Eub-basin in the South China Sea;

(xi) Orogenic Phenomena and Boundary Processes along Microplates.

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[1] A list of Acronyms is given in Annex IV.

Finally, the Assistant Secretary IOC reported that the Summary Report of the CCOP/SOPAC-IOC Workshop on Coastal Processes in the South Pacific Island Nations; Lae, Papua New Guinea, 1-8 October 1987, was submitted to the Twenty-first Session of the IOC Executive Council, Paris 11-17 March 1988. The Executive Council welcomed the report and thanked CCOP/SOPAC for its efforts to convene the Workshop. He also informed the Working Group that, in accordance with the Recommendation STAR III.2, the IOC Secretariat published a list of age data compiled by the Age Dating Study Group as IOC Technical Series No.32: "Radiometric Age of Islands and Seamounts in the Pacific".

The Working Group noted the various efforts made by the IOC during the reporting period, but expressed concern that the important projects of the South Pacific region received so little attention in the proposed work programme developed at the WESTPAC workshop. Again, the Working Group noted the need for development of a separate programme that focused on the needs of the region. The Working Group restated its opinion that this can only be accomplished by forming a regional organization separate from WESTPAC.

3.2 CCOP/SOPAC

Dr. Jim Eade, CCOP/SOPAC Technical Secretariat, reported briefly on CCOP/SOPAC activities. On Ocean Drilling, he has been appointed to the West Pacific Panel of ODP, and will attend a meeting to be held in October 1988 dealing with drilling in the South Pacific region. On information exchange, Mr. Jan Morel is the new person responsible for data management at CCOP/SOPAC Technical Secretariat. A report will be circulated during the CCOP/SOPAC session on the Workshop on Nearshore Minerals, held in Savusavu, Fiji, 3-8 October 1988. On remote sensing, acquisition of SPOT images of Aitutaki has been completed and acquisition of images of other areas is in progress. A draft proposal on the use of submersibles in region has been prepared by Mr. Donald Tiffin.

4. FOLLOW-UP OF THE COASTAL PROCESSES WORKSHOP

Dr. Russell Howorth reported to the Working Group the results of the Workshop held in Lae (PNG), 1-8 October 1987. This presentation having been made last year to an informal STAR meeting, the seven recommendations made at the Workshop were endorsed by the Technical Advisory Group to CCOP/SOPAC in 1987, which asked that inshore expertise be represented on national delegations. Mr. John Harper of CCOP/SOPAC Technical Secretariat has drafted an informal work programme based upon the recommendations which will be examined by the Coastal Processes Study Group to see whether STAR can assist in the implementation. The Summary Report of the Workshop has been published as IOC Workshop Report No. 51, which is also considered as the CCOP/SOPAC Training Report No. 15. The proceedings have been edited and publication is scheduled for the first half of 1989 in a CCOP/SOPAC Technical Bulletin.

As both phases of the coastal emphasis have now been covered by Workshops, the Study Group may wish to review future plans. Dr. Howorth mentioned that sea-level change had emerged as a recommendation of the Savusavu workshop as it had also at Lae.

The Working Group accepted the report of Dr. Howorth and thanked him for his efforts to organize this remarkable Workshop with full participation of scientists from the region, together with international experts. It requested CCOP/SOPAC Technical Secretariat and IOC to seek possible ways and means for early implementation of the recommendations adopted at the Workshop.

5. REVIEW OF ON-GOING ACTIVITIES OF STUDY GROUPS

5.1 OCEAN DRILLING

Dr. Keith Crook, Leader of the Study Group, reported that the prospects for drilling by the Ocean Drilling Programme in the SOPAC region remain unchanged, with three legs likely in 1990/91: Northeast Australian margin, C. Vanuatu and Lau Basin (a full report is in Document IOC/INF-784). Some new proposals for drilling in the region have been logged in by the JOIDES office; none seems likely to be included in the 1990/91 drilling programme. He also reported that Australia would shortly be joining the Ocean Drilling Programme. The newly created Australian Research Council has indicated substantial funding support which together with funding from the Bureau of Mineral Resources (BMR), the Antarctic Division, and the Australian Vice-Chancellors' Committee, has led to firm proposals for a Canada-Australian consortium membership. The Australian ODP office will be located in a university. Five geoscience departments have submitted bids to house the office. An Australian ODP Interim Steering Committee, comprising representatives of funding agencies, which has already met, will shortly determine the successful bidder. The Leader felt that continuation of the Study Group was not essential because it was likely that ODP would be focussed on by future STAR Sessions.

The Working Group agreed that the Ocean Drilling Study Group be disbanded, and thanked the Leader and members for their efforts. It requested experts involved in ODP such as Drs. Keith Crook, Jim Eade, Loren Kroenke, Chuck Helsley and Bernard Biju-Duval, to monitor and report on ODP activities to the Working Group from time to time as needed.

5.2 AGE DATING

Dr. Barbara Keating, Leader of the Study Group, reported that the first task of the Study Group was compiled and the results were published as Radiometric Age of Islands and Seamounts in the Pacific (IOC Technical Series No. 32) which are available at the Session, or by writing to her or to IOC Secretariat. It was noted that a follow-up report is desirable. The Leader of the Study Group is contacting Dr. Tracy Vallier, USGS, requesting her to take on the updating of data.

The Chairman of the Working Group proposed that the Study Group be disbanded, since the primary task was completed.

The Working Group accepted this proposal and thanked the Leader and members of the Study Group for their efforts and the IOC for publishing the results.

5.3 TECTONICS

Dr. Loren Kroenke, Leader of the Study Group, reported that ad hoc and informal meetings have been held on various occasions of scientific meetings, and progress had been made on various objectives. Since the Third Session of STAR in September 1986, considerable progress has been made toward the original objectives of the Tectonics Study Group, i.e. to: (i) examine the historical development of plate margins in the South Pacific; (ii) investigate problems relating to the formation and deformation of lithosphere in the South Pacific, and (iii) determine rheological properties of the upper mantle beneath the South Pacific to evaluate boundary conditions, horizontal and vertical motions, and compositional heterogeneities of the asthenosphere.

Plans have been formulated and proposals submitted for studies that have significant bearing on the tectonics of the southwest Pacific including: the state of stress and inefficient trench formation in the Western Central Pacific Basin, north and east of the Ontong Java Plateau (i.e. the Micronesian Trench); the origin and development of submarine canyons on the Ontong Java Plateau (i.e. the Micronesian Trench); the fragmentation of the Northern Lau-Tonga Arc and the origin of the North Fiji-North Lau Basin Transition Zone.

Major reports on the tectonics of the region have been published in the Circum-Pacific Council for Energy and Mineral Resources (CPEMR), Earth Science Series on Tripartite work in: The Tonga Arc-Lau Basin, the Northern Melanesian Borderland, the Solomon Islands, the Woodlark Basin, Vanuatu and the New Ireland and Manus region. Papers have also been published and/or presented in the Lau Basin, North Fiji Basin, Woodlark and Manus Basins and the Solomon Sea. Tripartite cruise reports on the North Fiji Basin, Manus Basin and the Solomon Islands are in preparation. A study has been recently completed on Indo-Australia (IA) Plate motion back to 55Ma, based on the Hot Spot Frame of Reference and palinspastic reconstructions of the southwest Pacific have been made. Southwest Pacific tectonic maps been prepared for both the CCOP/SOPAC Geophysical Atlas of the Southwest Pacific and the CPEMR Circum-Pacific Map Series.

Two cruises have been recently completed in the Havre Trough and the Lau Basin. GLORIA side-scan, magnetics, conventional bathymetry and single channel seismic reflection data from the cruises are being used to investigate the tectonic structure of the Havre Trough. Preliminary analysis of the data has demonstrated that plate motions in this back-arc basin are significantly different from what was previously assumed (the tectonic fabric is oriented 050 degrees to

055 degrees which is about 25 degrees oblique to the overall trend of the Havre Trough/Kermadec Ridge/Kermadec Trench structure) and that crustal extension and perhaps seafloor spreading is occurring along a set of very short echelon grabens. Geochemical evidence suggests that there may be much intrusive and extrusive volcanism associated with seafloor spreading.

Analysis and interpretation of data are also in progress for cruises in the Lau Basin (SeaBEAM surveys on the R.V. THOMAS WASHINGTON, R.V. SONNE and R.V. JEAN CHARCOT), the North Fiji Basin (SeaMARC II surveys on the R.V. MOANA WAVE, SeaBEAM surveys on R.V. JEAN CHARCOT, R.V. SONNE and R.V. KAIYO), Woodlark and Manus Basins (SeaMARC II surveys on the R.V. MOANA WAVE) and Manahiki Plateau (SeaBEAM surveys on the R.V. SONNE and SeaMARC II surveys on the R.V. MOANA WAVE). A geological atlas is in preparation for the North Fiji Basin which might initially include the results of SeaMARC II surveys carried out by the Tripartite II and the French SEAPSO.

Planning is in the advanced stages for survey cruises in late 1988 - early 1989 to investigate backarc basin ridge crust and seafloor spreading processes in the Lau Basin on the R.V THOMAS WASHINGTON using SeaBEAM; North Fiji Basin on the R.V. KAIYO using SeaBEAM (Japan-France-CCOP/SOPAC: STARMER Programme); Havre Trough, North Fiji Basin, Woodlark Rift on the R.V. AKADEMIK MSTISLAV KELDYSH using two MIR submersibles (USSR).

ODP Drilling legs having major tectonic objectives are now planned to study the collisional processes of the D'Entrecasteaux Ridge - New Hebrides Arc collision zones, ridge crust processes in the Lau Basin and formation-deformation processes occurring along the Tonga Arc and in the Fore-arc.

Referring to Recommendation STAR-III.3, Dr. Neville Exon proposed to the Study Group that an international workshop could be organized to review major scientific achievements of the last few years and put them into their economic context in conjunction with the next CCOP/SOPAC annual session to be held in October 1989, in Canberra (Australia). After detailed discussion (see Document IOC/INF-784), the Study Group recommended the following topics, dealing with aspects of the Earth's crust and lithosphere, and geodynamic processes in the southwest Pacific, for consideration as topics in the proposed International Workshop:

(i) Resource and hazard implications of convergent margin processes, particularly those related to collision tectonics.

(ii) Southwest Pacific tectonic terrains: resource implications and data requirements.

(iii) Ophiolites, back-arc basin lithosphere and mineral deposits.

(iv) Comparative evolution and hydrocarbon potential of back-arc rift related basin margins.

(v) Intraplate tectonics, seamounts and resources.

The Working Group noted with satisfaction that the Study Group made great progress in the development of tectonic studies in the Region and requested the Group to continue such efforts.

The Working Group welcomed the proposal to organize the Third International Workshop on Geology, Geophysics and Mineral Resources in the South Pacific in conjunction with the next CCOP/SOPAC session to be held in Canberra, Australia, in 1989, and requested that representatives of STAR parent bodies, CCOP/SOPAC and IOC, be invited to the Organizing Committee of the Workshop. The Working Group adopted Recommendation STAR-IV.1.[2]

5.4 INFORMATION EXCHANGE

Mr. Yann Morel, the newly elected Leader, reported on the data management facilities within CCOP/SOPAC Technical Secretariat that enable information exchange of offshore database. Cruise schedules in the region are now periodically included in the SOPAC Newsletter, but more regular updating is needed.

The Study Group felt it necessary to ensure participation of CCOP/SOPAC Technical Secretariat, on behalf of the CCOP/SOPAC member countries, in the IOC Technical Committee on International Oceanographic Data Exchange System (IODE) to ensure efficient data exchange with other Oceanographic Data Centres as well as the WDCs. It recommended that South Pacific countries should continue to approach cruise organizers in order to obtain copies of the geophysical data from past cruises which are not available to the CCOP/SOPAC Technical Secretariat preferably in an international exchange format such as MGD-77 or GF-3.

The Working Group appreciated the efforts made by the CCOP /SOPAC Technical Secretariat and endorsed the recommendations made by the Study Group.

Recognizing the importance of quick information flow in the region, the Working Group adopted Recommendation STAR-IV.2.

5.5 ISLAND DRILLING

Mr. Rodney Walshaw, Leader of the Study Group, reported little progress since the Second Session of STAR held in Rarotonga in 1986. Twelve preliminary outline proposals have been reviewed, but no means for implementation have been devised. National Representatives of CCOP/SOPAC should also be asked to provide details of the existing drilling capacity of both Government and industry in their respective countries and be made aware of the drilling capability of the Acker Drilling machine at present owned by CCOP/SOPAC. The Study Group proposed that the use of the latter machine should be restricted to

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[2]The Recommendations are given in Annex II

resource study orientated drilling, such as the current Cook Islands phosphate investigation, or for shallow stratigraphic drilling as appropriate. It was emphasized that sites previously proposed are for shallow holes requiring light rigs (listed in Summary Report STAR-III). It was noted that there are suitable rigs available in all member countries but there is a difficulty to identify funding. A submission to the Australian review of geoscience aid in the Pacific is warranted.

The Working Group noted with concern the difficulty of implementation on identified sites due to lack of finance and requested CCOP/SOPAC Technical Secretariat to seek the possibility of funding. It adopted Recommendation STAR-IV.3.

5.6 COASTAL AND NEARSHORE PROCESSES AND RESOURCES

Dr. Bruce Richmond, CCOP/SOPAC Technical Secretariat, reported that, in addition to the report made in the previous theme by Dr. Howorth, fifty local scientists participated in the Workshop on Nearshore Minerals, 3-8 October 1988, held in Savusavu, Fiji, with special attention to precious coral, phosphates, placer deposits, and construction materials. Scientific presentations and field and office training exercises were carried out during the Workshop.

A draft management plan is under preparation by the CCOP/SOPAC Technical Secretariat to facilitate implementation of Recommendations made at the Coastal Process Workshop held in Lae (Papua New Guinea), in October 1987. The draft management plan, indicates specific actions that could be taken to implement the Recommendations. It was also noted that some progress had been made on these activities, such as the promise by Australia to implement a major, regional study of sea level change in the South Pacific and implementation of Environmental Impact Statement (EIS) Workshops in the region by the South Pacific Regional Environmental Programme (SPREP).

The Working Group accepted the report and urged both IOC and CCOP/SOPAC Technical Secretariat to seek possible ways and means to implement the recommended activities since problems on coastal zone are important for most of the member countries in the region.

5.7 REMOTE-SENSING

Dr. Lionel Loubersac, Leader of the Study Group, reported that following Recommendation STAR-III.5, CCOP/SOPAC Technical Secretariat completed the analysis of the satellite images of Aitutaki Atoll (Cook Islands). Two SPOT HRV tapes of Aitutaki in the Cook Islands have been bought by IFREMER and CCOP/SOPAC Technical Secretariat and processed at IFREMER and recently in the Technical Secretariat. A scientific publication on the impact of the cyclone Sally on Aitutaki and a booklet prepared both by IFREMER and the Technical Secretariat have been edited. Two technical reports on the Aitutaki study will be edited by the CCOP/SOPAC Technical Secretariat as a result of the project. The Guadalcanal image was acquired by BGS. Preliminary work has been prepared by British Geological Survey

(BGS), but not finalized due to the departure of a key investigator from his duty in the South Pacific. At the request of the Fiji Department of Mineral Resources the focus was changed to the study on the Ba river estuary from the originally planned area. The corresponding SPOT image acquired in April 1988, bought by IFREMER, and offered to the Government of Fiji (BMR) and will be stored at the CCOP/SOPAC Technical Secretariat for future work. No good imagery has been acquired on the Lae/Madang area due to cloud cover.

In order to accomplish its objectives the Study Group believes it is essential to promote the future acquisition of remotely sensed data for the region. Moreover, it will be necessary to formulate and undertake the study of remote sensing applications as an input to the STAR work programme. The Study Group reviewed the amount of data available at various locations. It also recognized the risk of duplication of work by the different organizations working in the field of remote sensing and the potential gap which would arise between those who will process and interpret the information and those in the member countries who are supposed to use it.

UNDP/ESCAP decided to launch a Remote Sensing sub-programme for the South Pacific. Mr. Daniel Van R. Claasen is in charge of this programme at USP. The objectives of this programme are focused on initiation in the use of remote sensing by providing technical advice, training technicians, assisting in executing small pilot projects and maintaining a flow of information.

The Study Group noted the information offered by the USSR delegate that the Soviet SOJUZKARTA is distributing the data acquired during USSR space missions; hence images are presently available in the Region. A copy of the Viti Levu image was offered to MRD. SOJUZKARTA will be contacted as to obtain the catalogue of existing cloud-free images of the CCOP/SOPAC region. It also noted the progress achieved by ORSTOM in processing Seasat data for detection of seamounts, particularly in gaining precision in location (close to 15km). Considering the major applied interest of seamount mapping (e.g. precious corals), the Study Group strongly wishes this programme to be continued.

The Working Group expressed its appreciation for the efforts made by the Study Group and the CCOP/SOPAC Technical Secretariat to carry out the pilot study in the Cook Islands. It noted that there are various possibilities to develop this valuable project with technical assistance from advanced countries and requested their co-operation to make the project a success. The Working Group expressed strong interest in obtaining from the USSR a set of images in analogue and digital form, hopefully without cost.

In view of the strong need of a coastal resources inventory mapping system, the Working Group strongly endorsed Recommendation STAR-IV.4 and hoped for early implementation.

5.8 SUBMERSIBLE AND ROV's

Dr. Bernard Biju-Duval, Leader of the Study Group, reported that there has been considerable progress in developing a schedule of French diving in the South Pacific for 1988/1989 using the Submersible CYANA which can dive to 3000 metres deep and NAUTIL to 6000 metres deep; **TEOHITIA** (CYANA Cruise: French Polynesia: December 1988-2 January 1989), **CALSUB** (CYANA Cruise: New Caledonia Basin: February 1989), **SUBSO** (NAUTIL Cruise: Vanuatu fore-arc: March 1989), **NAUTILAU** (NAUTIL Cruise: FRG-France Project: Lau Basin: April-May 1989) and **STARMER** (NAUTILE Cruise: France-Japan Project: North Fiji Basin: June 1989).

Targets are seamounts and carbonate aprons; subduction processes and collision in Vanuatu; opening of back-arc basins (North Fiji Basin) and Valu Fa Ridge hydrothermal systems. Discussions were held with HIG on cooperation to secure additional dives using the HURL PISCES submersible, but without positive outcome.

Following agreement between Australia and USA (Bureau of Mineral Resources, Victoria University and Hawaii Underwater Research Laboratory, (HURL)), new activity in the early 1990s in the southwest Pacific is expected for the submersible PISCES V. HURL received several proposals for possible use of its facilities and they will be examined. It was suggested that the opportunity be used to take advantage of this venue of submersibles to work on new topics in the southwest Pacific.

The evolution of the submersible fleet (and its possible application to the South Pacific) has expanded quite rapidly by the building of the SHINKAI (Japan),(capable down to 6500 metres) and the first operation of the two soviet submersibles MIR in the Atlantic. Development of new ROVs for shallow or deep exploration, for instance the HP ROV built by Monterey Bay Aquarium Research Institute, and able to operate down to 1500m depth through a fiber optic umbilical, greatly enhances the opportunities for subsea research.

The Working Group commented on the draft paper of D.L. Tiffin on "A Strategy for Use of Submersibles and ROVs in the CCOP/SOPAC Work Programme". It noted that the use of ROVs could certainly be very interesting on specific topics but recalled that ROVs do not provide the same view of the sea floor as manned submersibles and that deep ROVs may be also very expensive.

The USSR Delegate informed the Working Group about the project of the soviet cruise in the South Pacific (principal investigator : A. Lisitin). The Working Group noted possible overlapping with other scheduled projects, a lack of detailed information, the necessity of better coordination, and the precise role of the submersible during the cruise.

In conclusion, the Working Group, recognizing the potential scientific merit of the soviet programme, requested that:

(i) a detailed document be prepared including the scientific objectives of the different targets;

(ii) an effort of coordination be made with CCOP/SOPAC and national agencies in charge of the submersible activity in the CCOP/SOPAC region.

The Working Group welcomed the fact that various research was carried out by using submersibles and noted that any new technological development for submersibles and ROVs has to be properly considered, especially to conduct experimentation at the bottom of the sea. The Working Group adopted Recommendation STAR-IV.5.

6. REVIEW OF PROGRESS RELATIVE TO SCIENTIFIC KNOWLEDGE WITHIN THE SOUTH PACIFIC REGION

The STAR scientific session reviewed the progress relative to scientific knowledge in the South Pacific through the presentation of seventeen papers (Abstracts are in Document IOC/INF-784). The authors and titles of these presentations are:

Gary Greene: Final Results of Vanuatu Tripartite Work.

Lou Garrison: Ocean Drilling Project Plans for the South Pacific Region.

Gary McMurtry: Recent Evidence for Hydrothermal Mineralization in the North Fiji Basin: Hydrothermal Plumes an Metalliferous Deposits.

Loren Kroenke: The Development of New plate Boundaries in the North Fiji Basin: A Geologic Atlas of the North Fiji Basin.

Barbara Keating: Neo-volcanism in the Line Islands Seamounts (Eastern Kiribati).

Keith Crook, Robert Musgrove, B. Taylor, N. Exon and R. W. Johnson: Structure and Evolution of the Woodlark Triple-Junction.

Don Tiffin: A Strategy for Use of Submersibles and ROVs in the CCOP/SOPAC Work Programme.

Eiichi Honza, J. M. Auzende and KAIYO 87 Participants: STARMER PROJECT: Japan, France and South Pacific Countries Joint Research Programme in the Oceanic Rift in the South Pacific Basin.

N. Yonekura, A. Sugimura, and others: Holocene Sea Level Changes and Tectonics in the Middle Pacific.

B. M. Larue: Plate Movements in the South Pacific: Results from Focal Mechanism Studies

Bill Coulbourn, Peter Hill, and Doug Bergerrsen: Machias Seamount, Western Samoa: Tectonic Dismemberment and Subduction of a Guyot

Eric De Carlo: Geochemistry and Resource Potential of Fe-Mn Deposits from the Equatorial Pacific Ocean

Gary Greene: Preparation of Pacific Basin Paleogeographic Map and Final Proof of Southwest Quadrant Tectonic Map

Bill Coulbourn and Peter Hill: A Field of Mud Volcanoes on an Oceanic Plateau

Mike Cruickshank: Marine Minerals Technology Center: a new Thrust

Loren Kroenke and C. Y. Yan: Palinspastic Reconstruction of Cenozoic Plate Boundaries in the Southwest Pacific

V. V. Zdorovenin: Cooperative Research: An Organizational Response of Marine Science to New Challenges

The Working Group welcomed the presentations given during the scientific session and urged that similar sessions be held during future sessions. The Working Group, particularly the Member Country representatives, responded that this new aspect of the STAR session was very valuable and provided them with considerable insight and useful information.

7. OCEAN BASIN MINERAL RESOURCES AND TECHNOLOGY

At the request of the Chairman, an ad hoc Group met to exchange views on scientific studies of ocean basin mineral resources and related technology.

7.1 DEEP SEABED NODULES

A Japanese cruise of the R.V HAKUREI MARU II to the Cook Islands waters, east of the Manihiki Plateau, in 1986, has led to the recovery of extensive abyssal nodules. The nodules which completely blanket the sea floor in certain areas are mineralogically and compressionally similar to seamount crusts. They are primarily MnO_2 (vernadite) and are enriched in cobalt as opposed to todorokite nodules such as those from the region between the Clarion and Clipperton fracture zones which are enriched in Cu and Ni. Although the cobalt content is reported in the 0.5 - 0.7%,range the large quantity of these nodules represents a potential resource.

Some scientific questions which can be addressed include: (i) why is the mineralogy dominated by MnO_2 rather than todorokite? (ii) why is the coverage so extensive that nodules coalesce to form? (iii) what effect does the Antarctic bottom water play on the growth of the nodules? (iv) what are the differences in sedimentation patterns in this area relative to todorokite - bearing nodule fields (if any) and what role does sedimentation play in the formation of these nodules?

7.2 COBALT-RICH MANGANESE CRUST

Two cruises of the R.V MOANA WAVE and the R.V. HAKUREI MARU II to the Phoenix Islands area have yielded considerably different grades of deposits yet very similar morphologies for the recovered crusts. A number of thin (less than 30mm) crusts highly enriched in Co (1-2%) were recovered by the R.V MOANA WAVE in 1986. The crusts dredged from depths of less than 2000 metres were also found to be associated with carbonate fluorapatite intergrowths and often underlain by phosphatized cementing of Fe-Mn fragments as substrates. Dendritic growths of Fe-Mn minerals were also found in the phosphorite. Recent work suggests that diagenesis of carbonate sediments led to the release of Mn and Fe oxide replacements of carbonates and that these may have precipitated contemporaneously with the deposition of apatite. The source of the carbonate is presumed to be algal mats. A number of scientific questions which need to be addressed include: (i) is the Co-rich Fe-Mn that which is precipitated contemporaneously with apatite? (ii) did the phosphorites form rapidly, at shallow depth from the diagenesis of algal sediments or was there a massive anoxic event which led to the deposition of extensive phosphate deposits? (iii) what factors (time, redox conditions, etc.), control the deposition of Co-rich crusts? (iv) were phosphate cements formed after the Fe Mn fragments they surround? (v) are there genetic differences in the Fe-Mn crusts, dendrites in phosphatized rocks, and in the fragments cemented by apatite? (vi) what is the influence of depositional setting on crust formation (paleo-oceanographic conditions)?

7.3 METALLIFEROUS SULPHIDES

Indications of hydrothermal mineralization were recently reported in the South Lau Basin and in the North Fiji Basin during cruises of the R.Vs SONNE, KANA KEOKI and MOANA WAVE. Follow-up work is planned in this area to investigate these anomalies in more detail.

7.4 PHOSPHORITES

Work on evaluation of phosphorite deposits on the Chatham Rise east of New Zealand, in water depths of about 400 metres, was completed some years ago by German and New Zealand researchers. Examination of the deposits was carried out only to the depth accessible to the sampling grab used during the study. Additional work

involving penetration of the underlying bedrock and more detailed studies on the distribution and genesis of the phosphorites is warranted.

7.5 PRECIOUS CORALS

The relationship of precious corals to their physical and chemical environment is not well understood. Understanding of the conditions limiting their establishment and growth is needed to develop strategies for their assessment and protection on a regional basis. Areas in the Line Islands have been proposed as acceptable sites for research. Concerning assessment of technology used in the collection of data on deep seabed resources,the ad hoc group endorsed strongly the use of submersibles and ROVs for the utilization of in situ resource data in deep water. It was stressed, however, that in some cases the technology for this work was not well developed. In particular the measurement of physical and engineering properties of seabed rocks, encrustations and hard substrates, in place, is an important need in resource development and has scarcely been addressed. The acquisition of these data on an opportunity basis, during planned submersible activities, would be useful to the regional scientific and technological data base. The technology for hard-material sampling is similarly not well developed and needs to be improved, particularly with respect to the controlled selection of sampling locations and the acquisition of samples beneath the seabed, and in bulk quantities.

With respect to the above concerns, the ad hoc group recommended that:

(i) efforts be made to ensure maximum use of submersibles and ROVs to acquire in situ data on engineering properties on an opportunity basis throughout the region.

(ii) The Study Group, when established, should examine the existing technology for acquisition of data and the sampling of hard materials to determine the scope for appropriate and cost-effective improvements.

(iii) A Workshop on "State-of-the-Art of in situ Measurements of Physical and Engineering Properties of Hard Materials in the Deep Sea-Bed" is proposed for 1990.

In conclusion, the ad hoc group noted that: activities of STAR emphasize coastal and nearshore processes and resources; there is a natural differentiation between the mineral resources of the nearshore and deep ocean basins; and there is need to review and report on the minerals of the deep ocean basins and the technology required for their scientific study.

The Working Group decided, on the basis of the ad hoc group report, to establish a Study Group on Ocean Basin Mineral Resources and Technology and adopted Recommendation STAR-IV.6.

8. DATE AND PLACE OF THE FIFTH SESSION

After considering the various options for the Fifth Session of STAR, the Working Group agreed the session should be held in conjunction with the Eighteenth Session of CCOP/SOPAC, tentatively scheduled for Canberra, Australia, in October of 1989. The exact date and venue of the Session will be determined by the CCOP/SOPAC Technical Secretariat. The Working Group concurred that STAR should be a co-sponsor of the proposed Workshop scheduled for the next CCOP/SOPAC meeting and that the scientific portions of this Workshop would be the content of the STAR meeting.

9. ELECTION OF CHAIRMAN AND VICE-CHAIRMAN

In accordance with the agreements reached at the Third Session, the Chairman and Vice-Chairman tendered their resignations at the end of the current Session. Nominations were solicited from the Working Group for candidates for Chairman and Vice-Chairman for the next two year term.

Dr. Charles Helsley, the current Chairman, was nominated by Mr. Fanatoia Malele (Samoa) and elected Chairman, and Dr. Ronald Richmond, the current Vice-Chairman, was nominated and elected as Vice Chairman.

10. CLOSURE

On behalf of Joint Working Group, the Chairman thanked the Technical Secretariat of CCOP/SOPAC for the local arrangements and support of the Session and the participants for their valuable input to the discussion and scientific planning that went on during the Session.

The Chairman closed the Session at 19:30 hours 21 October 1988.

ANNEX I

AGENDA

1. OPENING OF THE SESSION

2. ADOPTION OF THE AGENDA

3. INTERSESSIONAL ACTIVITIES

   3.1 Intergovernmental Oceanographic Commission
   3.2 CCOP/SOPAC

4. FOLLOW-UP OF THE COASTAL PROCESSES WORKSHOP

5. REVIEW OF ON-GOING ACTIVITIES OF STUDY GROUPS

   5.1 Ocean Drilling
   5.2 Age Dating
   5.3 Tectonics
   5.4 Information Exchange
   5.5 Island Drilling
   5.6 Coastal and Nearshore Processes and Resources
   5.7 Remote-Sensing
   5.8 Submersibles and ROVs

6. REVIEW OF PROGRESS RELATIVE TO SCIENTIFIC KNOWLEDGE WITHIN THE SOUTH PACIFIC REGION

7. OCEAN BASIN MINERAL RESOURCES AND TECHNOLOGY

   7.1 Deep Seabed Nodules
   7.2 Cobalt Rich Manganese Crust
   7.3 Metalliferous Sulphides
   7.4 Phosphates
   7.5 Precious Corals

8. DATE AND PLACE OF THE FIFTH SESSION

9. ELECTION OF CHAIRMAN AND VICE-CHAIRMAN

10. CLOSURE

ANNEX II

RECOMMENDATIONS

Recommendation Number	Title
STAR-IV.1	Tectonics Study
STAR-IV.2	Information Exchange
STAR-IV.3	Island Drilling
STAR-IV.4	Remote-Sensing
STAR-IV.5	Submersibles and ROVs
STAR-IV.6	Ocean Basin Mineral Resources and Technology

RECOMMENDATION STAR-IV.1

TECTONICS STUDY

The Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources,

Noting that remarkable progress has been made in tectonic studies in the South Pacific region by various groups and that major reports have been published or are under preparation (e.g., Tripartite work in the Tonga Arc-Lau Basin, the Northern Melanesian Borderland, the Solomon Islands, the Woodlark Basin,Vanuatu and New Ireland, the Manus Region; Indo-Australia Plate motion back to 55 Ma; southwest Pacific tectonics maps), and numerous major research cruises have been carried out in the South Pacific region,

Recognizing that high-level research activities are being carried out to investigate extensional features behind convergent margins and the developmental history of back-arc basins, but that the driving mechanisms and processes involved remain unclear,

Noting further that the region also provides many opportunities for comparative studies which are particularly relevant to the evolution and hydrocarbon potential of back-arc basin rift margins,

Noting further the importance of understanding the origin and growth of seamounts, particularly those in the intraplate area of the southwest Pacific, in relation to resource studies,

Recalling Recommendation STAR-III.3 on the organization of the Third CCOP/SOPAC-IOC International Workshop on Geology, Geophysics and Mineral Resources in the South Pacific,

Recommends that the forthcoming CCOP/SOPAC-IOC Workshop, to be held in Canberra in 1989, consider the incorporation of a new theme, "Tectonics of the Southwest Pacific: Significance for Resources and Hazards", to review recent advances in geo-scientific research into geodynamic processes involved in the formation and deformation of the earth's crust and lithosphere in the South Pacific region,

Also recommends that CCOP/SOPAC Technical Secretariat and IOC seek possible sources of funding to hold the Workshop.

RECOMMENDATION STAR-IV.2

INFORMATION EXCHANGE

The Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources,

Noting with satisfaction that efforts made by the CCOP/SOPAC Technical Secretariat to disseminate information on cruise schedules in region,

Recommends that the CCOP/SOPAC Technical Secretariat update such information on a regular basis;

Recommends that IOC and the CCOP/SOPAC Technical Secretariat seek possible ways and means to enable the participation of the Data Management Unit of the CCOP/SOPAC Technical Secretariat in the IODE System on behalf of the CCOP/SOPAC member countries; and

Recommends that CCOP/SOPAC Member Countries continue approaching cruise organizers in order to obtain copies of geophysical data of past cruises, that are not available to the CCOP/SOPAC Technical Secretariat, preferably in an international exchange format such as MGD77 or GF3.

RECOMMENDATION STAR-IV.3

ISLAND DRILLING

The Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources;

Noting the lack of response to Recommendation: STAR-III.4,

Re-affirms the importance of stratigraphic drilling to the assessment of the petroleum resources and the acquisition of scientific knowledge to the region;

Recommends that the CCOP/SOPAC Technical Secretariat vigorously pursue the implementation of the regional island drilling programme.

RECOMMENDATION STAR-IV.4

REMOTE-SENSING

The Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources,

Noting the need of the CCOP/SOPAC member countries for acquisition of remotely sensed data,

Recognizing the need to formulate and undertake remote sensing studies as an input to various STAR work programmes,

Also noting the importance of co-operating with other groups to encourage the development of expertise in the use of remotely sensed data among the SOPAC countries,

Recognizing the amount of data available at various locations and the lack of information on its location and availability,

Also recognizing the potential gap which would arise between those who will process and interpret the information and those in the SOPAC Member Countries who are supposed to use it,

Recommends that the Remote-Sensing Study Group co-operate with appropriate regional bodies, including the ESCAP Regional Remote-Sensing Project, in the inventory and compilation and update of a catalogue of available South Pacific remote-sensing data coverage (e.g. air photography, satellite analog and digital images);

Recommends that the Remote-Sensing Study Group and the CCOP/SOPAC Technical Secretariat actively co-operate with the countries in the region in the publication of a newsletter about remote-sensing activities in the South Pacific;

Recommends that each SOPAC Member Country nominate a remote sensing coordinator for activities relating to its country, to act as a point of contact between that country and the regional co-ordinator, and to work towards the establishment of a remote-sensing network in the South Pacific region;

Recommends that the CCOP/SOPAC Technical Secretariat and IOC take a co-ordinating role in exchanging experiences of individual technical and scientific remote-sensing experts and organizations, such as IFREMER and ORSTOM, in and out of the region;

Recommends that an integral part of any or all projects incorporating remote-sensing data analysis be the training of member country (geological) experts in such applications;

Recommends that the Remote-Sensing Study Group prepare, in co-operation with IFREMER, ESCAP, MRD, SPREP, CCOP/SOPAC Technical Secretariat and IOC a prototype of standard coastal and nearshore mapping based upon the use of the North West Viti Levu images and data and to present this at the next STAR Session.

RECOMMENDATION STAR-IV.5

SUBMERSIBLES AND ROVs

The Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources,

Recognizing the importance of the use of submersibles and ROVs to address problems in different scientific fields of interest,

Noting the potential scientific merits in newly proposed submersible dives in the region,

Recalling the central co-ordination role of the CCOP/SOPAC Technical Secretariat in dissemination of information related to past and future

diving plans in the region which were recommended at the STAR Workshop on the Use of Submersibles and Remotely Operated Vehicles,

Recommends that each organizer of research dives be invited to submit the advance detailed documentation for each site, including background scientific data, to the CCOP/SOPAC Technical Secretariat so that proper evaluation and co-ordination of scientific objectives can be achieved in each of the proposed target areas.

RECOMMENDATION STAR-IV.6

OCEAN BASIN MINERAL RESOURCES & TECHNOLOGY

The Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources,

Noting that activities of CCOP/SOPAC emphasize coastal and nearshore processes and resources,

Noting also that there is a natural difference between the mineral resources of the nearshore and deep ocean basin,

Noting further that there is a need to review and report on minerals of the deep ocean basins and the technology required for their scientific study,

Noting the usefulness of submersibles and ROVs in obtaining *in situ* data and engineering properties,

Recommends the formation of a STAR Study Group on Ocean Basin Mineral Resources and Technology in order to:

(i) Provide a forum for advocacy of research on ocean basin minerals distinct from nearshore resources,

(ii) Monitor and generate information exchange on deep-water activities in the SOPAC region dealing with manganese nodules, cobalt-rich manganese crusts, metalliferous sulphides and other offshore resources such as phosphorites and precious corals,

(iii) Examine the technology used, and seek to identify and recommend improved practices where appropriate,

(iv) Develop plans for workshops or training activities on the technology for scientific studies of ocean basin minerals.

ANNEX III

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ANNEX IV

LIST OF ACRONYMS

BMR	Bureau of Mineral Resources (Australia)
BGS	British Geological Survey
CCOP/SOPAC	Committee for Co-ordination of Joint Prospecting for Mineral Resources in South Pacific Offshore Areas
CPEMR	Circum-Pacific Council Energy and Mineral Resources
DMR	Department of Mineral Resources (Fiji)
DSDP	Deep Sea Drilling Project
ESCAP	UN Economic and Social Commission for Asia and the Pacific
GLORIA	Geological Long Range Inclined Asdic
HIG	Hawaii Institute of Geophysics (University of Hawaii, USA)
HURL	Hawaii Underwater Research Laboratory
IA	Indo-Australian Plate
IDP	Island Drilling Programme
IFREMER	Institute Francais de Recherche pour l'Exploitation de la Mer
IODE	International Oceanographic Data and Information Exchange (of IOC)
JOIDES	Joint Oceanographic Institutions for Deep Earth Sampling
ODP	Ocean Drilling Programme
ORSTOM	Institut Francais de Recherche Scientifique pour la développement en coopération (previously Office de la Recherche Scientifique et Technique Outre-mer)
OSNLR	Ocean Science in Relation to Non-Living Resources
RMRDC	Regional Mineral Resources Development Centre
ROV	Remotely Operated Vehicle

SEAPSO	Sea-beam dans le Pacifique Sud-Ouest
SEATAR	CCOP-IOC Joint Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
SPOT	Satellite pour l'Observation de la Terre
SPREP	South Pacific Regional Environmental Programme
STAR	Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
UN	United Nations
UN(OETB)	UN Economics and Technology Branch [1]
UNDP	United Nations Development Programme
USGS	Geological Survey of the United States of America
USP	University of the South Pacific (Fiji)
WESTPAC	IOC Regional Committee for the Western Pacific

[1] Disbanded