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MINERAL RESOURCES IN SOUTH PACIFIC OFFSHORE AREAS

TRAINING SESSION REPORT: BASIC MARINE GEOLOGY & GEOPHYSICS

5 - 16 July 1976

by

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UNDP Project RAS/72/122: South Pacific Offshore Prospecting

Prepared as a contribution by the Technical Secretariat of CCOP/SOPAC to assist in the training of member country personnel and the development of offshore prospecting capabilities in countries of the South Pacific region.

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CCOP/SOPAC TRAINING SESSION 5-16 JULY 1976

SUVA, FIJI

Introduction and Background

As part of the original objectives of UNDP Project RAS/72/122 in assisting member countries develop their capability to assess potential offshore resources, it was considered necessary for member country personnel to work closely with the UNDP Marine Geologist both during reconnaissance survey cruises and during follow-up training sessions. After completion of the first CCOP/SOPAC field programmes in Western Samoa, Tonga, and the Cook Islands (see attached cruise reports), a two-week training session was held at the office of the CCOP/SOPAC Technical Secretariat, Suva, Fiji from 5-16 July 1976. Travel funds, enabling CCOP/SOPAC member country personnel to attend the training session, were provided by the Intergovernmental Oceanographic Commission (ICC). In addition to providing an opportunity to follow up the on the job training carried out during survey cruises, the session also provided participating trainees with a more comprehensive exposure to basic concepts in marine geology and geophysics which had already been introduced during the survey cruises. Moreover, it was considered vital that the trainees participate in actual data processing and data reduction, working with their own data acquired during their respective survey cruises.

Participants in the CCOP/SOPAC training session included:

Mr Edward Winterstein, Marine Survey trainee, Western Samoa;
Mr. Etueni Tupou, Marine Survey trainee, Tonga; and
Mr. Edwin Utanga, Marine Survey trainee, Cook Islands.

Also in attendance, at selected lectures, were trainees from the Fiji Mineral Resources Division. The co-operation and support of the Fiji Mineral Resources Division contributed greatly to the success of the training session. In particular, highly instructive and informative lectures were presented by Mr. Ronald Richmond, Director, Fiji Mineral Resources Division; Mr. Howard Plummer, Assistant Director, Fiji Mineral Resources Division; and Dr. Howard Colley, Geologist, Fiji Mineral Resources Division. Members of CCOP/SOPAC participating in the training session included Dr. L.W. Kroenke, UNDP Marine Geologist, and Mr. C.W. Landmesser, UNDP Consultant on Marine Geology and Geophysics.

Format of the training session

In an effort to provide the participating trainees with a comprehensive coverage of selected topics in marine geology and geophysics and, at the same time, also provide an opportunity to further develop skills through working on geophysical data acquired during their respective survey cruises, a series of lectures, discussions, films and laboratory/workshop sessions was planned. A narrative of daily activities organized during the two-week training session is attached as Appendix: 1. Topics which were covered during the sessions included: basic terminology used in the fields of geology and geophysics; maps and map projections; various geomorphological features encountered in the ocean basins and at their margins; a review of geological and geophysical survey and sampling methods; the geologic time scale; a description of the internal structure of the earth; review of various types of seafloor deposits and potential resources derived from certain types of deposits; and the history and origin of the ocean basins. Other topics covered by members of the Fiji Mineral Resources Division included: the history and organization of the Geological Survey in Fiji; the factors contributing to the constitution of an economic mineral deposit; and a comprehensive introduction to rocks and rock forming minerals. The trainees also benefited from an opportunity to tour the facilities at the Fiji Mineral Resources Division, being able to observe, at first hand the daily activities of various departments and the types of geological and geophysical exploration presently being carried out by the Geological Survey of Fiji.

For a considerable part of the two-week session, the trainees were engaged in reduction and analysis of bathymetric data obtained during their respective survey cruises. During Laboratory/Workshop periods, efforts were made to relate aspects of the course material being covered to the data being worked on. This served to increase the trainees awareness of the nature and significance of various features appearing on the bathymetric profiles. It had been originally planned that the trainees would plot and contour their bathymetric data and begin preparation of a final report. This report, in combination with the analyses of the bottom samples and the bottom photographs taken during the cruises would then provide the basis for forthcoming issues of South Pacific Marine Geological Notes. Unfortunately, the time allocated was insufficient for the completion of these efforts. Notwithstanding

the results of the reconnaissance cruises have now been reviewed and efforts are continuing to produce charts of the offshore areas surveyed incorporating all available pre-existing bathymetric data with the data obtained during the recent member country cruises.

Comments and Recommendations

In view of the amount of background material needed to be covered during the two-week training session, as well as the amount of data from survey cruises required to be analyzed, it was the consensus of the participants that two weeks were insufficient to cover and assimilate the amount of material presented, and that future sessions should be planned either for a longer duration or deal with more limited topics than the broad range of subjects covered by this session.

A great deal of enthusiasm was engendered however, and considerable interest was expressed in establishment of a short course in geology at the University of the South Pacific. Establishment of such a course, might also lead to member country personnel to apply for more advanced fellowships and perhaps encourage them to enroll in and attend institutions in the Pacific region offering full bacheloureate degrees in geology and geophysics.

In view of the distance factor, which creates problems in co-ordinating training activities in the South Pacific region, it is recommended that the University of the South Pacific Satellite network be utilized for organizing and supplementing the training sessions conducted by the CCOP/SOPAC Technical Secretariat in Suva.

In general, it should be realized that while training sessions, as discussed above, are necessary in developing the capabilities of member country personnel, it is essential that these sessions be supplemental to the continued field activities in offshore areas of the individual member countries. There appears to be no substitute for actual experience in developing a complete understanding and working knowledge in marine geology and geophysics. Toward this end the continuation of on the job training through participation in offshore survey cruises throughout the region was viewed as essential and strongly recommended by all participating member country personnel.

APPENDIX 1

CCOP/SOPAC TRAINING SESSION 5-16 JULY 1976:

NARRATIVE: Monday 5 July

8.30 a.m. Introduction to Geology- and Geophysics. Dr. L.W. Kroenke, UNDP

Marine Geologist welcomed the trainees and introduced the topics to be covered during the training session. Some basic terminology used in the science were introduced and explained, and the general objectives of the science, working toward an ability to predict geological occurrences of economic mineral resources and certain geological phenomenon, such as earthquakes, were discussed.

9.00 a.m. Tour of Fiji Mineral Resources Division, Geological Survey, Mead Road, Suva, Fiji. Led by Mr Abdul Rahiman of the Fiji Mineral Resources Division, the trainees were shown facilities at the Geological Survey, including Seismograph, Sample Preparation facilities, chemical analysis Laboratory, Drawing office, Library, as well as examples of rock cores, seismograph data, thin sections, and rock and mineral specimens.

10:00a.m. Coffee.

10.30 a.m. Maps and Map Projections. Dr. L.W. Kroenke introduced the various types of maps used to portray features on the earth's surface. Included in the discussion was an explanation of latitude, longitude, and map projections from a three dimensional globe to two dimensional maps.

Land Forms and Seafloor Topography. Dr. L.W. Kroenke and Mr. C.W. Landmesser led a descriptive treatment of submarine geomorphology, discussing both the large-scale features that dominate sea-floor terrain (such as oceanic ridges, trenches, basins, plateaus) and specific topographic anomalies (such as seamounts, volcanic islands, atolls, and coral reefs).

1.00 - 2.00 p.m. - Lunch.

2.00 - 4.30 p.m. Laboratory Workshop: Data Storage and Handling.

Dr. L.W". Kroenke and Mr. C.W. Landmesser discussed the organization and preparation of geophysical and geological data and the trainees made necessary preparations to work on the data obtained during their respective survey cruises. Rolls of bathymetric data were inventoried and numbered, and both time and depth scales were prepared for use in picking bathymetry from the geophysical records.

Tuesday 6 July

8.30 - 10.00 a.m. Submarine geomorphology Mr. C.W. Landmesser- continued the discussion of geomorphological features, including continental margins, submarine canyons, fracture zones, abyssal hills, and abyssal plains. This was followed by an introduction into various geophysical and geological surveying and sampling methods, including seismic reflection, seismic refraction, magnetics, gravity, heat flow seismology "deep-tow" methods, piston coring, bottom photography, dredging and free fall sampling methods. This discussion served to broaden the trainees' understanding of methods already made familiar to them during the survey cruises.

10.00 - 10.30 a.m. Coffee.

10.30 - 1. 00 p.m. Geologic Time Scale. The trainees were introduced to the concept of geologic time and the breakdown of the time scale into various periods was explained. The discussion progressed to an introduction to contour and geological maps, and an explanation of some of the structural features (i.e, faults, folds" etc.) encountered in geology.

1.00 - 2.00 p.m. Lunch.

2.00 - 4.30 p.m. Continuation of the Laboratory Workshop. Trainees began analysis of bathymetric data obtained during the survey cruises, checking and tabulating bathymetry picked during the cruises and picking bathymetry in areas missed during the cruises. During this workshop period, geomorphological features on the records were discussed and reviewed in light of possible occurrences of economic

mineral deposits in the respective areas.

Wednesday, 7 July

8.30 a.m. - 1.00 p.m. Introduction to rocks and rock forming minerals.

Dr. Howard Colley of the Fiji Mineral Resources Division led a discussion of the ,major mineral groups, including their description and instructions on how to identify certain minerals by studying their crystal symmetry, colour, lustre, hardness, cleavage, etc. The formation of ore minerals was also discussed, and the mineral composition of the major rock types was outlined, with emphasis on those rock types characteristic of the Southwest Pacific region.

10.00 - 10.30 a.m. Coffee.

1.00 - 2.00 p.m. Lunch.

2.00 - 4.30 p.m. Continuation of Laboratory Workshop.

Thursday, 8 July

8.30 - 10.00 a.m. Structure of the Earth. Mr. Landmesser led a discussion of the internal structure of the earth, including thickness, velocity and density Variations in the lithosphere and mantle. Variations between continental and oceanic crust were also discussed, and the concept of isostasy was introduced. The discussion then turned to a description of various seafloor deposits, including various sediment types and their depositional environments, as well as deposits of economic interest, particularly manganese nodules, phosphorite, detrital minerals, and petroleum resources. Reference was made to samples recovered during the survey cruises in each country, and the nature of material recovered was discussed. The relationship between the characteristics of various samples recovered and the depositional environment (i.e. volcanic island arc, seamount, abyssal hills, etc.) were discussed to provide the trainees with a better understanding of the factors controlling the types of deposits found, or expected to be found, in particular areas.

10.00 - 10.30 a.m. Coffee.

10.30 a.m. - 1.00 p.m. The Origin of the Ocean Basins. Dr. L.W.

Kroenke led a discussion and presented a series of slides related to the formation and deformation of the: earth's crust; this presentation further elaborated on concepts, of seafloor spreading and the tectonic processes active in the earth already described in earlier lectures, and. served to bring together many of the concepts dealt with earlier in the training session.

1.00 - 2.00 p.m. Lunch.

2.00 - 4.00 p.m. Continuation of Laboratory Workshop and bathymetric data analysis.

Friday, 9 July

8.30 - 10.00 a.m. Economic Mineral Deposits. Hr. Howard Plummer, Assistant Director of Mineral Development, Fiji Mineral Resources Division, lectured and led a discussion on factors contributing to the economic nature of certain mineral deposits. The combination of geology, mineral technology, legal constraints, and political factors must be considered in evaluating a mineral deposit. These factors were elaborated on and particular reference was made to the exploitation of potential marine resources as applicable to the trainee's respective countries.

10.00 - 10.30 a.m. Coffee.

10.30 - 11.30 a.m. Organization of a Geological Survey: Goals and Objectives.

Mr Ronald Richmond, Director of Mineral Development, Fiji lectured and led a discussion on the history of the Fiji Mineral Resources Division, and. recent involvements of the Mineral Resources Division in the fields of seismology, mineral exploration, and marine geological studies. This presentation provided the trainees with an excellent example of how a geological survey is set up and organized, with possible reference to initiation of similar governmental departments to deal with mineral resource

development in member countries presently in the formative stages of establishing capabilities in the field of geological exploration.

11.30 a.m. - 1.00 p.m. Offshore Mineral Resource of the South Pacific. Mr. C.W.

Landmesser led the discussion of potential mineral resources in the South Pacific region. Aspects of certain areas conducive to the formation of certain economic mineral deposits were presented and applied to the potential in various countries of the Southwest Pacific.

1.00 - 2.00 p.m. Lunch.

2.00 - 4.30 p.m. Continuation of Laboratory Workshop and bathymetric data analysis.

Monday 12 July through Friday, 16 July

In view of the amount of bathymetric data obtained during the offshore survey cruises, the second week of the training session was devoted primarily to data analysis and interpretation. The trainees continued to work on the bathymetric records obtained during survey cruises, working with the UNDP Consultant to get a further understanding of features revealed by the records, as well as geophysical aspects of the sounding methods used to obtain the records. It was originally hoped that there would be sufficient time for the trainees to actually plot and contour the bathymetric data, thereby utilizing and interpreting the data further while producing a bathymetric contour chart of each area.

Also during the second week a series of films, provided by the U.S. Embassy in Suva, Fiji was presented. The films, covering such topics as earthquakes, development of natural resources, and the programme of deep-ocean drilling by the Glomar Challenger, provided an excellent supplement to material covered during lectures and discussions.