Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources

Eleventh Session

Guangzhou, China, 13 November 1985

Unesco

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CCOP-IOC/SEATAR-XI/3
Paris, 26 May 1986
English only

In this Series

Reports of Meetings of Experts and Equivalent Bodies, which was initiated in 1984, the reports of the following meetings have already been issued:

- Third Meeting of the Central Editorial Board for the Geological/ Geophysical Atlases of the Atlantic and Pacific Oceans
- Fourth Meeting of the Central Editorial Board for the Geological/ Geophysical Atlases of the Atlantic and Pacific Oceans
- Fourth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of «El Niño»
- First Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in relation to Living Resources
- First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in relation to Non-Living Resources
- First Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
- First Session of the Joint CCOP (SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
- First Session of the IODE Group of Experts on Marine Information Management
- Tenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Tectonics and Resources
- Sixth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
- First Session of the IOC Consultative Group on Ocean Mapping
- Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ships-of-Opportunity Programmes
- Second Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
- Third Session of the Group of Experts on Format Development of the Working Committee on International Oceanographic Data Exchange

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The Session was attended by representatives from the following Member States: Australia, Canada, People's Republic of China, France, Indonesia, Japan, Malaysia, Netherlands, Norway, Papua New Guinea, Philippines, Republic of Korea, Singapore, Thailand, Union of Soviet Socialist Republics, United Kingdom, United States of America. Representatives of ESCAP and IUGS also attended the meeting as well as staff of the CCOP Secretariat and the UNDP/ESCAP Technical Support Team to CCOP. The List of Participants is given in Annex II.

The Agenda adopted for the meeting is given in Annex I.

The Eleventh Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources (SEATAR) was held in Guangzhou, China, on 12 November 1985, under the chairmanship of Dr. Gunther Giermann. Dr. J. Ringis and Dr. R.J. Rogerson were designated Rapporteurs for the Session.

Dr. Giermann welcomed the members of the Working Group and conveyed the best wishes of Secretary IOC, Dr. M. Ruivo. He congratulated the Group for the continuing high standard of its work which has made the SEATAR programme one of the most successful in intergovernmental scientific co-operation. He regretted that, due to the recent developments in Unesco, the IOC budget was also undergoing considerable cuts which do not allow the Commission to react immediately to the requests made to the Commission at the Tenth Session of SEATAR, which included the secondment of staff to the UNDP/CCOP Project Office in Bangkok, and the funding of a SEATAR Co-ordinator. At present, there is little hope that this situation could be remedied immediately, but compromises may be possible. IOC would certainly continue to provide travel funds in cases of urgency, and would participate in the data compilation/synthesis exercise to be achieved before the Circum-Pacific Conference.

The Chairman expressed the wish that SEATAR closely co-operate with the geological-geophysical programme of WESTPAC, in particular the Ocean Science in Relation to Non-Living Resources (OSNLR) component. He also invited the Group to seek closer contacts with other important IOC programmes such as regional International Bathymetric Charts (IBC's), International Oceanographic Data Exchange (IODE) and Training, Education and Mutual Assistance in the Marine Sciences (TEMA). He reminded the Group that he himself, over a period of more than a decade, had helped to build up confidence between the Commission's Member States and the members of CCOP and SEATAR, and he called upon the Group to continue work in this co-operative spirit, which in the past had led to so much success.

Dr. John Katili, CCOP's Principal Co-ordinator for SEATAR, who was unable to participate in the session, also conveyed his best wishes for a successful meeting and once again emphasized the importance of the resources aspects of the SEATAR programmes.

2. REVIEW OF ACTIONS TAKEN BY THE CCOP PROJECT OFFICE AND IOC SINCE THE LAST SESSION

Intersessional activities of the CCOP Project Office included the following:

(i) A request was made to the organizers of the Circum-Pacific Energy and Mineral Resources Conference to be held in Singapore, in August 1986, to provide booth space for the display of SEATAR transect compilations. A favourable response was received and five booths, with a combined total of 45 metres of wall space, will be made available for that purpose. Time will also be allocated for a review of SEATAR transect activities to be presented at one of the technical sessions (25 minutes).

(ii) Dr. J.R. Curray of the Scripps Institution of Oceanography was engaged as overall SEATAR Transect Co-ordinator for a period of five weeks in July/August and 3 weeks in November, to : (a) help individual Transect Co-ordinators to commence the synthesis of data along the transects using the uniform formats adopted at the Tenth Session of the SEATAR Working Group in Bandung, in 1984; and (b) continue that work and help conduct and report on the Transect Co-ordinators' meeting held in Bangkok, on 7-8 November 1985. Support for engaging Dr. Curray was provided jointly by the UNDP/CCOP Project Office and by IOC.

(iii) A meeting of SEATAR Transect Co -ordinators was held in Bangkok, on 7-8 November 1985, including arrangement of funding for attendance by some member country participants, and close liaison with the Thai Department of Mineral Resources in making arrangements for host facilities; attendance of two participants was funded by IOC.

(iv) Information was sent to concerned countries on proposed marine geophysical research activities in the South China Sea by Lamont-Doherty Geological Observatory, with a request for comments and endorsement of the proposed work; favourable reactions were received from all of the concerned countries.

(v) Future SEATAR activities were discussed in some detail in a meeting with Dr. M. Ruivo, Secretary IOC, in early May 1985. The Intergovernemntal Oceanographic Commission, despite its financial difficulties, provided, since the last SEATAR session, the amount of approximately US$10,000, for travel by Dr. Curray and two of the Transect Co-ordinators to attend the meeting in Bangkok, as described above.

3. DISCUSSION OF THE REPORT AND RECOMMENDATIONS OF THE TRANSECT CO-ORDINATORS' MEETING HELD IN BANGKOK, 7-8 NOVEMBER 1985

Dr. Curray, the Chairman of the Transect Co-ordinators' Meeting in Bangkok, 7-8 November 1985, introduced the Report and Recommendations to the Working Group for its consideration and endorsement; the Report is attached as Annex III hereto.

Dr. Curray reminded the Group that the SEATAR programme had commenced in 1973 at a workshop held at Bangkok. Six transects had been originally proposed and it had been assumed that the results of studies along those transects would be published at the end of the 1970-1980 International Decade of Ocean Exploration (IDOE). At the SEATAR Workshop held in Bandung, Indonesia, in 1978, four more transects had been added to the programme, but no firm plans had been formulated for publishing the results of studies along each transect in an integrated form. Since that time a number of scientists have been concerned with achieving this, and the meeting held in Bangkok on 7-8 November 1985 had been an important step in that direction.

The Recommendations formulated at that meeting were considered by the Working Group. It endorsed recommendations 1, 2, 3, 4, 5, 6, 7, 8 and 9 and took note of recommendations 4a and 4b; it requested the CCOP Project Office to take the necessary steps to implement those recommendations in co-operation with the other bodies mentioned.

4. REPORT ON ACTIVITIES ALONG SEATAR TRANSECTS BY TRANSECT CO-ORDINATORS

Brief reports on the work carried out along their respective transects were presented by Transect Co-ordinators, and summaries of those reports are given in Annex IV hereto.

5. REPORTS ON ACTIVITIES IN RELATED NON-SEATAR PROGRAMMES

United Kingdom

Dr. C. Jones presented two reports summarizing research work carried out by the British Geological Survey in Indonesia, Malaysia and Thailand. In BGS Mineralogy and Petrology Report 85/14, compiled by J.F.W. Bowles, final conclusions of the precious metal and associated base metal mineralization project in Indonesia and Malaysia were presented.

The second report summarized 1985 results of the Five-year Southeast Asia Tin Granite Project, which now has one year to run.

It is significant that the British Geological Survey work on precious metals, reported in report 85/14, predicted a continuation into Kalimantan of gold mineralization found in northern Sumatra. Prior to the BGS work, Kalimantan had no mineral exploration concessions, but by late 1985, a large number of concessions had been taken up.

Australia

Dr. J. Branson outlined research cruises presently being undertaken in the Coral Sea by the Australian Bureau of Mineral Resources using the vessel RIG SEISMIC. He also announced further cruises in the Coral Sea in 1986. The Coral Sea is crossed by Transect X and is adjacent to Transect IX.

Two-ship reflection and long-offset refraction profiles are to be carried out in March 1986 with the Lamont-Doherty Geological Observatory using the CONRAD and the RIG SEISMIC, across the Exmouth Plateau. Results from this cruise would be of assistance in the understanding of the more complex convergent continental margins being studied along Transects IV and VII.

Other research programmes using the RIG SEISMIC are not expected to be undertaken near CCOP transects until late in 1987.

USSR

Professor Chistiakov stated that marine geological/geophysical data, gathered during expeditions sponsored by the Academy of Sciences of the USSR and by the Ministry of Geology were published in scientific journals in the USSR. He drew the Group's attention to the recently published "Neotectonic Map of the World "at a 1:15 million scale. Scientists of the USSR will submit to SEATAR a paper entitled "The Main Stages of Cenozoic Evolution of the Transitional Zones of the Western Pacific". In addition to that paper, the USSR will present palaeogeographic maps for the Palaeocene, Eocene, Oligocene, Middle Miocene, Late Miocene and Early Pliocene, at 1:10 million scale. The Far East Institute of Volcanology and Seismology plans to organize a marine scientific cruise along Transect Ic early in 1987.

USA

Dr. D. Hayes, of the Lamont-Doherty Geological Observatory, presented a brief summary of work recently completed in the South China Sea in a co-operative programme between the South China Sea Headquarters and Lamont-Doherty Geological Observatory (see Annex IV). Dr. G. Moore (CPMP) pointed out that the proof of the Northwestern Quadrant Geological Map was displayed at the meeting and any comments or corrections should be relayed to him as soon as possible, especially if they concern the SEATAR programme. Printing of the final map is expected to take place in 1986.

Dr. T. Ovenshine (USGS) informed the Group of the plans of the International Strategic Mineral Group (USGS) to undertake a 4-ye programme of assessing reserves of undiscovered lode tin. The plans were being finalized and would be communicated to CCOP.

IUGS

Dr. Sinding Larsen reminded the Group of results of IGCP Project 220 (East Asian Tin Granite Studies) and Project 224 (pre-Jurassic Evolution of East Asia). He stated that certain results of SEATAR studies would be

relevant to the Joint IUGS-CCOP-ASCOPE Basin Analysis Project. The IUGS sponsors workshops/symposia on mineral resources (e.g., the Symposium on Mineral Deposit Modelling and Remote Sensing) which are relevant to SEATAR studies.

6. FUTURE WORK PROGRAMME AND MEETINGS

The Working Group was reminded that, at its Tenth Session in Bandung, Indonesia, in 1984, it had been proposed that a SEATAR review/planning meeting be held during or just after the Circum-Pacific Energy and Minerals Conference in Singapore in August 1986. At such a meeting final details of SEATAR transect compilations and publications could be considered and possible future directions/work programmes for SEATAR (or post-SEATAR) activities formulated.

It was pointed out to the Working Group that since many, if not all, of the Transect Co-ordinators and other concerned scientists would be attending that conference (at which the transect poster sessions were to be held), little extra cost would be incurred in holding such a meeting, and a good attendance would be assured.

The Working Group was also informed that the 6th GEOSEA Conference would be held in Jakarta in about April 1987 and that this would be another good opportunity to hold such a meeting.

The Working Group agreed that the Project Office, in consultation with concerned parties, should resolve the question of which would be the best venue/time for that proposed meeting.

7. DATES, PLACE AND AGENDA FOR THE TWELFTH SESSION OF THE JOINT WORKING GROUP

The Working Group agreed that its Twelfth Session should be in conjunction with the 23rd session of CCOP which was to be held in Papua New Guinea in late 1986. The Agenda would include a consideration of potential IPOD drilling targets in the SEATAR region and related operational questions. Other items on the Agenda for that meeting will be formulated by CCOP and IOC and circulated to Member States in due course, together with an invitation to attend.

8. OTHER MATTERS, INCLUDING CONSIDERATION OF IOC'S PROPOSED REVISION OF SEATAR TERMS OF REFERENCE

The Draft New Terms of Reference for SEATAR (Annex V hereto), which had been made available to CCOP Member Countries at the Tenth Session of SEATAR and to IOC Member States by Circular Letter after the session, were put to the Working Group for final consideration and adoption, but since the representatives of the Philippines and Japan had not been given instructions by their governments on this subject, the Working Group agreed to postpone consideration of the new mandate to the Twelfth Session of SEATAR, in 1986.

9. ADOPTION OF THE REPORT AND CLOSURE OF THE SESSION

A short meeting was convened on Tuesday, 19 November, to adopt the Report. The Report and Recommendations were adopted and the Eleventh Session was closed.

ANNEX I

AGENDA

1. OPENING OF THE SESSION AND ADOPTION OF THE AGENDA

2. REVIEW OF ACTIONS TAKEN BY THE CCOP PROJECT OFFICE AND IOC SINCE THE LAST SESSION

3. DISCUSSION OF THE REPORT AND RECOMMENDATIONS OF TRANSECT CO-ORDINATORS' MEETING HELD AT BANGKOK, 7-8 NOVEMBER 1985

4. REPORTS ON ACTIVITIES ALONG SEATAR TRANSECTS BY TRANSECT CO-ORDINATORS

5. REPORTS ON ACTIVITIES IN RELATED NON-SEATAR PROGRAMMES

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7. DATES, PLACE AND AGENDA FOR THE TWELFTH SESSION OF THE JOINT WORKING GROUP

8. OTHER MATTERS, INCLUDING CONSIDERATION OF IOC'S PROPOSED REVISION OF SEATAR TERMS OF REFERENCE

9. ADOPTION OF THE REPORT AND CLOSURE OF THE SESSION

ANNEX II

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ANNEX III

REPORT AND RECOMMENDATIONS OF THE SEATAR TRANSECT CO-ORDINATORS MEETING HELD IN BANGKOK, THAILAND, 7-8 NOVEMBER 1985

A. OPENING OF THE MEETING AND ADOPTION OF THE AGENDA

The meeting was opened on 7 November by Dr. Chamrat Mahawat, Department of Mineral Resources, Thailand, who welcomed the participants on behalf of the Thai Government. He stressed that to be successful, the meeting should be conducted in as informal a manner as possible.

Dr. John Ringis (Team Leader, UNDP/ESCAP Technical Support Team to CCOP) thanked the Director General of the Department of Mineral Resources, Thailand, for making facilities available for conducting the meeting. He also conveyed Professor Katili's regrets at not being able to participate. In addition, Dr. Ringis relayed to the participants that Dr. Katili urged all to emphasize the resources aspect of SEATAR activities. Dr. Katili also wished the participants well in their attempts to integrate individual transect parts. Dr. Curray was elected to chair the meeting and the following Agenda was adopted:

1. Opening of the meeting
2. Discussion of plans and schedules for publication and funding
3. Discussion of standard formats for sections, maps, and summary report volumes
4. Working sessions to assemble and integrate parts of individual transects
5. Reports on the progress for each transect
6. Adoption of report and close meeting.

Co-ordinators for all transects were present, except for Transect 6 (Japan and South Korea). A Representative of ESCAP was also present. All participants are listed in Attachment 1. A list of final recommendations follows as Attachment 2.

B. DISCUSSION OF PLANS AND SCHEDULES FOR PUBLICATION AND FUNDING

The meeting resolved the following

1. Transect Co-ordinators should contact all geoscientists who have done recent work on their transects as soon as possible to request them to submit abstracts with preliminary results of work and/or letters of intent to contribute papers for the transect publication volumes. Final manuscripts should be submitted to the Chief Co-ordinator by 1 December 1986, for technical and scientific outside peer review.

2. Transect Co-ordinators should have all transect maps and sections in standard hard-coloured format by August 1986 for display in the scheduled poster sessions at the Circum-Pacific Conference in Singapore. Dr. Katili should be invited to offer a general paper on the history, philosophy, and results of the SEATAR Transect Project in a 25-minute presentation scheduled by the Conference organizers for the purpose, in one of the technical sessions

3. By 1 April 1987, transect summary reports by the Transect Co-ordinators, with any co-authors they choose, should be submitted to the Chief Co-ordinator for technical editing and outside scientific review.

4. All SEATAR transect reports should be published in a standard, high-quality format as soon as possible after completion of editing and review. Each transect will be a separate volume in the series, published by the same publisher and released at the same time. Each transect report will also include a folio of maps and sections in standard format and printed in colour.

5. A Chief Co-ordinator should be engaged for two years, starting as early as possible in 1986 and based in the CCOP office. He should be adequately funded so that he can assist the individual Transect Co-ordinators and seek additional funds for publication of the final SEATAR reports.

6. Beginning in September 1986, following display of the maps and sections in Singapore, approximately one man-year of drafting services will be required to ensure uniformity and quality of the maps and sections.

7. Quality publication of SEATAR results will have to be financially supported. It is estimated that the cost of publishing 1000 copies of a 200-page book is approximately US$30,000, and nine person-months of editing cost US$40,000, then US$130,000 will be required during 1986 and 1987 to fund publication of the summary reports and prepare the maps and sections for printing. Map and section printing cost will be dependent on final choice of printing method and type of material (paper vs. clear transparent overlays), but a total of about US$120,000 may be required for colour map and section printing, for a total estimate of US$250,000.

C. STANDARD FORMATS FOR MAPS, SECTIONS, AND VOLUME

The Transect Co-ordinators agreed to the following resolutions:

1. All SEATAR transect results should be published in as standard a format as possible

2. Maps.

a) Base maps should be compiled using a Mercator projection of 1° Long. = 4 inches, the standard US marine plotting sheet, with a scale very close to 1:1 000 000. Transect IV should be plotted on this projection at half the scale, or about 1:2 000 000, and some long marine segments of other transects (e.g., Transect V) can also be at a reduced scale. Transect VI, can be at either Mercator projection or a conic projection, at the discretion and agreement of the Co-ordinators.

b) Maps should not exceed approximately one metre in either dimension.

c) Colour scheme as used by USGS, and as most recently adapted to the Elsevier Geological Time Scale

d) Symbols as used by USGS both for geological and resource maps. For tectonic maps, use Hamilton map symbols. Palaeomagnetic data should be displayed using the symbols used by Jarrard on the Hayes and Taylor tectonic map.

e) Heat-flow map should show a combination of the good features of the Hayes and Taylor tectonic map, the Anderson et al. map in the Hayes atlas, using mW-metre.

f) Seismicity and focal mechanism should be displayed as on the Hayes and Taylor tectonic map. Precise focal depth in kilometres should be shown as numerals in addition to depth-class symbols. Benioff zones should be contoured.

g) The resources map or maps are extremely important, and should show symbols as used on the atlas of mineral resources of the ESCAP region. Attempts should be made to indicate deposit model types by symbol and also show deposit size on some maps.

h) Drs. Curray and Rogerson should investigate the relative costs of different possible printing methods and materials (e.g., paper coloured maps vs. clear transparent plastic coloured line maps).

3. Sections

a) Earth curvature should not be shown on sections.

b) Scale of sections should coincide precisely with scale of maps so that sections could be placed along section locations on maps.

c) Sections should be stacked as detailed in Attachment 1 to the report and recommendations of the Tenth Session of the Joint Working Group on SEATAR.

d) Section segments, when published, should not exceed approximately one metre in either dimension.

4. Volume

a) A volume will be published for each transect. It will consist first of contributions, either new and original, or reprinted from the recent literature, on various aspects or segments of the transect study, by various authors. Second, it will include a summary or synthesis paper by the Transect Co-ordinator with co-authors of his choice, outlining the tectonics and relation to economic resources. All contributions should be subjected to outside peer review for scientific merit and content and to internal technical editing.

b) All authors, including the Co-ordinators, should follow the guide for authors for the AAPG Bulletin, with the exception that all co-authors, regardless of numbers over four, should be listed in the list of references.

D. WORKING SESSIONS TO ASSEMBLE AND INTEGRATE TRANSECTS

Transect Co-ordinators and others working on the transects held working sessions to agree upon transect centrelines and pivot points.

Transect	Pivot Points	Centre Lines
I	98°E 21°N	continues along 16° N
	100°E 16°N	
II	88°E 12°N	continues along 8° N
	94°30E 12°N	
	96°E 8°N	
III	97°E 8°N	
	101°20E 3°N	
	100°E 4°N	
	112°E 7° N	
VIII	124°E 1°N	

Working session time was also used to display some transect compilations already completed by some Co-ordinators.

E. REPORT ON THE PROGRESS FOR EACH TRANSECT

It was resolved to defer these reports until the Eleventh Session of the Joint CCOP-IOC Working Group on SEATAR, in Guangzhou, China, on 12 November 1985.

F. OTHER MATTERS

It was resolved that:

1. Professor Ktaili be asked to present a general 25-minute talk on SEATAR at the Circum-Pacific Conference, Singapore, in August 1986.

2. In a letter to CCOP, Dr. Workman, University of Hong Kong, proposed a new transect running N-S through Hong Kong. The participants agreed that Dr. Workman's proposal had much scientific merit, but that it was impractical to consider new transect proposals at this stage, in view of the tight publication schedule proposed for the SEATAR transect project. They agreed, however, that Dr. Workman should be urged to submit a contribution from his work to the Co-ordinators for Transects I and V, for publication in the transect volumes.

3. Dr. Balce reminded all participants of the Symposium on Mineral Deposit Modelling to be held in Manila, 4-15 December 1985. Given the importance of resources to the SEATAR project, the participants recommended that more such workshops be held in this region, with adequate financial support.

ATTACHMENT 1

LIST OF PARTICIPANTS

G.R. Balce	Philippines
Chongphan Chonglakmani	Thailand
J. Curray	USA
B. Elishewitz	UNDP/ESCAP Technical Support to CCOP
F. Hehuwat	Indonesia
D. Jongama	Netherlands
L. Macheaky	ESCAP, Bangkok
Chamrat Mahawat	Thailand
J.A.E. Malicse	Philippines
R. Raid	UNDP/ESCAP Technical Support to CCOP
J. Ringis	UNDP/ESCAP Technical Support to CCOP
R. Rogerson	Papua New Guinea (rapporteur)
J.A.M. Ten Ca te	UNEP/ESCAP Technical Support to CCOP
S. Tjokrosaputro	Indonesia
M. Untung	Indonesia
Fookhong Yee	Malaysia

ATTACHMENT 2

RECOMMENDATIONS

The Transect Co-ordinators Meeting strongly recommended the following for consideration by the Joint CCOP-IOC Working Group on post-IDOE Studies in East Asian Tectonics and Resources:

1. That in view of the importance placed on SEATAR by CCOP member countries, reports of SEATAR results should be published in a memorable, high-quality form.

2. That the following publication schedule for final transect reports be endorsed, with the recommendations for standard formatting of sections, maps and volumes, as detailed in the Report of the Transect Co-ordinators Meeting of 7-8 November 1985. The proposed schedule is:

   17-22 August 1986 - Presentation of final maps and sections at the Circum-Pacific Conference, Singapore.

   September 1986 - Start final drafting of maps and sections.

   1 December 1986 - Deadline for individual papers for the transect volumes. Start scientific and technical editing.

   1 April 1987 - Deadline for summary papers on each transect by the Transect Co-ordinators, with co-authors of their choice.

   1987 - Publication of final reports. Each transect will be a separate volume in the series, published by the same publisher and released at the same time. Each transect report will also include a folio of maps and sections in standard format and printed in colour. If this schedule is to be realized, it is essential that the following requests for funding, provision of in-kind inputs, and employment of a co-ordinator be met.

3. That Professor Katili be invited by the Joint Working Group to present a general 25-minute talk on the SEATAR Transect Project at the Circum-Pacific Conference, August 1986. Time for such a presentation has been made available in a technical session of the Conference to advertise the transect poster sessions to be presented at the Conference.

4a. That IOC, UNDP, ESCAP, CCOP member countries, CCOP donor countries, ASCOPE, and private sector organizations should be approached to consider providing a total of up to US$250,000 in cash or in kind to fund final publication of the SEATAR Transect Project results over a period of two years. For a breakdown on this figure, see section B7 of this report.

4b. That CCOP should be asked to consider providing approximately US$250,000 in 1986 to fund the start of uniform drafting of SEATAR transect maps and sections after the Circum-Pacific Conference in Singapore, August 1986.

5. That, since all recommendations made in the 30 November 1984 Transect Co-ordinators meeting have been completed, the Transect Co-ordinators now recommend that IOC and CCOP and/or donor countries should also be asked to consider providing all costs of employing a full-time person within the CCOP office to co-ordinate these final reports. Selection and recruitment of this person should occur as soon as possible and he or she should be on the job no later than April 1986.

6. That Dr. Workman's proposal to co-ordinate a new N-S transect passing through Hong Kong not be included as a separate transect at this time because it would be virtually impossible to compile all data and integrate it with other South China Sea data by August 1986. However, Dr. Workman should be asked to consider publication of his work as a supporting paper for the Transect I final publication.

7. That those member countries not currently active in the present transect studies be urged to contribute to these final compilations.

8. That IOC should be asked to view favourably earlier requests to provide an annual budgeted sum of at least US$40,000 for on-going SEATAR activities beginning in 1986, as the present ad hoc provision of funds by IOC did not allow for effective planning of SEATAR activities.

9. That the Joint Working Group consider urging more support by IOC, CCOP, ESCAP, UNDP and other organizations of follow-up investigations of specific resource-related problems raised by preliminary SEATAR results. They should also be urged to support more symposia and conferences emphasizing resource-related topics like the one on Mineral Deposit Modelling to be held in Manila, 5-14 December 1985.

ANNEX IV

REPORT ON ACTIVITIES ALONG SEATAR TRANSECTS BY INDIVIDUAL TRANSECT CO-ORDINATORS

SEATAR Progress Report for Malaysia: Transects III and VII

The National Committee for SEATAR met twice during the year to discuss matters pertaining to studies along the Malaysian parts of Transect III and VII. The outcome of these meetings is the agreement by various members of the Committee to assist in the compilation of cross sections and maps in time for the 1986 Circum-Pacific Conference in Singapore. Very limited field work was carried out along the transects due to shortage of funds and organizational priorities. Some preliminary compilation of available transect data was started. Along Transect III some progress has been made in the compilation of seismotectonic, gravity and magnetic data. PETRONAS has agreed to compile offshore data for the transect. For Transect VII preliminary compilation of geological and seismotectonic data was completed pertaining to the land area of the transect. Some progress was also made by PETRONAS on the compilation of data pertaining to offshore Sarawak. These data include heat flow, gravity, magnetics, tectonics and geology for profiles and strip maps.

Indian Ocean - Sumatra - Peninsular Malaysia - South China Sea: Transect III

With the conclusion of the mapping programme of North Sumatra by the Directorate of Mineral Resources of Indonesia in co-operation with the Institute of Geological Sciences (UK) much more has become known of the geological history and structure of the Sumatra part of the transect, especially as far as the Pre-Tertiary is concerned.

Starting at the Indian Ocean plate which is being subducted below the Eurasian plate, the transect crosses the outer arc at the island of Nias. Tertiary sediments deposited in fault-controlled trench/slope basins mostly consist of turbidites and associated pelagic sediments show severe deformation induced by low angle thrust-faults associated with the shear along the Benioff zone. Next, the transect crosses the outer arc basin where predominantly pelagic Tertiary sediments were deposited on a pre-Tertiary basement whose nature is not completely clear. Deformation of these sediments was mainly associated with basement highs and faults which resulted in open folds and warping. The area west of the Sumatra Fault Zone (SFZ) where the transect crosses Sumatra, consists mostly of Late Jurassic-Early Cretaceous fine grained pelagic sediments frequently associated with ultrabasic rocks. In the vicinity of important faults, deformation is severe, especially near the SFZ where some of the rocks become slightly metamorphosed.

Granites of Mesozoic and Tertiary age intrude the Upper Mesozoic sequence. To the east of the SFZ the Tertiary sediments are underlain by Permo-Carboniferous and Permo-Triassic Rocks which can be correlated with sedimentary formations of similar age in Peninsular Malaysia and Thailand.

Deformation of the Tertiary sediments, consisting mostly of paralic to shallow marine sediments, shows a decrease in intensity going from the SFZ where they are tightly folded in asymmetrical folds with abundant high angle thrust-faulting, to weakly folded or warped in the east.

The western part of Transect III across the Malay peninsula consists of Lower Paleozoic metasediments, essentially foliated schists and marble, unconformably overlain by an Upper Paleozoic sequence of argillites and arenites.

The central part of the transect crosses shelf type sediments of Permo-Triassic age which are characterized by frequent intercalations of volcanics.

The eastern part of the transect consists of a mixed facies of argillites and volcanics of Late Paleozoic age.

The dividing line between the western and eastern parts is the so-called Bentong Line (or suture) along which ultrabasic rocks have been emplaced.

The western and eastern belts are intruded by granite plutons forming huge, elongate batholiths parallel to the North-Northwesterly structural grain of the country rocks.

Gravity and magnetic data suggest similar tectonic structure along both coasts and two gravity minima characterize the western and eastern belts, separated by a gravity maximum indicating the presence of denser and more basic upper crust. This tripartite division of the Malay peninsula is supported by the sedimentation history and evolution, and tectonic development of the sedimentary basins comprising the peninsula. Not much data have been available of the eastern part of Transect III where it crosses the Sunda shelf and continues to the South China Sea.

From seismic records, however, it could be ascertained that the Lupac zone and associated melange is clearly discernible, separating the shelfal area from the South China Sea basinal area.

As the original centre line of Transect III crosses Sumatra at a part where many complications are known, and as large parts of the transect area are covered by the acid Toba-tuffs, it has been agreed to shift the centre line of the transect slightly to the South.

Progress Report on Transect IV - Banda Arc

Banda Arc Transect data, both onshore and offshore have been collected by various institutions. Land-based studies of the Banda Arc and adjacent areas were conducted by:

1. Geological Research and Development Centre: West Timor, Tanimbar, Kai, Seram, Buru and Banggai Sula.
2. B.M.R./G.R.D.C. : Misool and Irian Jaya.
3. London University : Timor and East Seram.
4. The Flinders University : Sumba and East Timor.
5. Snellius II Expedition : West Timor, Kai, Seram and Buru.
6. Oil Companies : Timor, Seram and Irian Jaya.

Land studies included geological and geophysical studies. The geological study covered the whole area of the Banda Arc and adjacent areas. Previous geological compilations have been done by Hamilton (1979). Geophysical studies include palaeomagnetism, gravity and seismicity.

Palaeomagnetism:

Seram : N.S. Haile (1978)
East Timor : F.H. Chamalaun (1978)
West Timor : F.H. Chamalaun (1980), and Snellius II (1984). The data are being processed.

Offshore studies, including seismic reflection/refraction, magnetics, bathymetry, gravity profiling, heat flow measurements and seismicity were also conducted during the Banda Sea Programme.

Seismic Profiling:

1. Bangai Sula, Buru, Seram, Misool, Kepala Burung Irian Jaya and East Halmahera. : Pacific III, R.V. RESOLUTION 1981, (seismic reflection), Letouzey, et al. (1983).
2. Banda Sea Area : Corindon III leg I, R.V. CORIOLIS, 1981, (seismic reflection), Lapouille, A., et al. (1981).
3. Arafure Sea, Aru Trough : B.G.R. West Germany, MV SONNE, 1981 (seismic reflection/refraction).
4. Back arc thrusting and collision zone Sulawesi, Banda, Flores and Sumba. : U.C.S.C., R.V. T. WASHINGTON, Rama Expedition, (seismic reflection/refraction), Silver, et al. (1981).
5. Sawu Sea : B.G.R. West Germany, R.V. VALDIVIA, 1977, (seismic refraction), K. Hinz (1977).
6. Central Banda Sea, Timor, Sawu and South of Sumba : Sinta Expedition, R.V. KANAKEOKI, 1983, (seismic reflection), Silver and Hussong, et al. (1983).
7. Banda Sea and Timor Sea : R.V. ATLANTIS II and R.V. T. WASHINTON (seismic reflection/refraction), Bowin, et al. (1980).

8.	Molucca Sea, Banda and Arafure Sea	:	R.V. T. WASHINGTON, 1976, (seismic reflection/refraction), Jacobson, and Purdy, et al. (1977).
9.	Sulawesi and Molucca Sea	:	R.V. T. WASHINGTON, 1979, Mariana Expedition leg. 9.
10.	Banda Sea and North Irian Jaya (Biak)	:	R.V. T. WASHINGTON, 1976, (seismic reflection), G.G. Shor, et al. (1977).
11.	Banda Arc and adjacent areas	:	R.V. TYRO, Snellius II Expedition, 1984 Dutch and Indonesian scientists, (seismic reflection).

Bathymetry:

Bathymetric profiling was carried out in most of the cruises. Sea-Marc II side scan swath mapping has been tested and conducted at several localities in the Banda, Sawu and Timor Seas.

A section of the Banda Sea, Tukang Besi Trough, Wetar Subduction complex, Sawu Basin, Roti Strait, Timor Trough, South of Sumba and Flores Basin were studied. SeaMARC II worked well in this section in spite of a large swell.

Continuous Magnetic profiles were recorded during most cruises. A magnetic anomaly map of the Banda Sea Region was published by Bowin, et al. (1980).

Heat Flow:

Bowin, et al. (1980)	:	Heat flow measurements were made throughout the Banda Sea and adjacent basins.
Jacobson, et al. (1977)	:	As above.
Snellius II (1985)	:	Three heat flow measurements were made in the Northern Banda Sea.

Gravity:

Gravity measurements were continuously recorded during each cruise.

Bouguer Gravity Anomaly map of Banda Sea	:	Bowin, et al. (1980) Green and Untung (1979)
Free Air Gravity Anomaly Map of Banda Sea	:	Bowin, et al. (1980) Watts, et al. (1978)

Seismicity:

Cardwell and Isaacks (1978)	:	Earthquake records in eastern Indonesia were examined.
McCaffrey R., et al. (1978)	:	A field seismicity programme in Molucca Sea.
Papp (1981)	:	3 dimensional model of seismicity in Banda Sea region.

The above data have been published in local and international journals such as The Geology and Tectonics of Eastern Indonesia. Proceedings of the CCOP-IOC SEATAR Working Group Meeting July, 1979, Geological Research and Development Centre Special Publication No. 2, pp 1-415.

Report on Luzon-Mariana: Transect V

Inspite of the availability of an impressive volume of information on the transect, such as those published in international journals from 1974 and those contained in the 1981 and 1983 monographs published by the American Geophysical Union (AGU), work on the transect has remained active since the 1984 SEATAR Working Group Meeting.

Work on the ophiolites of Zambales Range and Southern Sierra Madre was continued by several investigators, including those of three Filipinos on fellowship in American Universities under the tutorship of D.E. Karig of Cornell and Michael Fuller of UCSB. Sedimentological studies, tectonics, metallogenesis of chromite and noble metals, and palaeomagnetics were pursued with the same vigour as in previous years. Reports on the noble metals will be presented in the Mineral Deposit Modeling Symposium to be held in Manila from December 5-14, 1985.

In the Luzon Central Basin, new information was generated as geophysical records were re-evaluated in preparation for drilling of new exploration wells to commence in the coming months. On the Luzon Central Cordillera, new geological mapping by the Bureau of Mines and Geo-Sciences (BMG) at 1:50 000 scale added new information on stratigraphy and structure. A joint project between BMG and researchers from the University of Nantes, France, on petrology and metallogenesis of the Cordillera is expected to start in February 1986. This is a follow-up of earlier investigations by French scientists on the petrology of calc-alkaline volcanic piles in the Batanes Island Group north of Luzon.

In the previously unmapped Sierra Madre Ranges on the east side of Luzon, the Joint RP-Japan Survey of geology and mineral resources was completed in August 1985. All southern Sierra Madre and Polillo Islands geological and geochemical maps at 1:250 000 and 1:50 000 scales will be made available for this area by December 1985. Work on the northern part of the Sierra Madre will commence in April 1986 under this project. The output of this and other spot investigation surveys of tectonically important areas are expected to provide adequate data for understanding the nature and evolution of this part of the transect.

The offshore areas east and west of Luzon have been covered by new geological and geophysical information published by Lewis and Hayes in 1984. A recent cruise of R.V. JEAN CHARCOT west of Luzon is expected to bring about more precise definition of the structure and evolution of the Manila Trench.

In view of the recently formulated programme to compile and publish a new comprehensive SEATAR volume, extensive search for published and unpublished transect data is being undertaken by a group under the direction of the Transect Five Coordinator. Base maps at 1:1 000 000 scale have been compiled on Mercator projection. Available geological and geophysical data are being transferred to this base. The transect is now envisaged to be an east-west strip centered along latitude 17°N. Portions covering the South China Sea, West Philippines would be bounded on the north by latitude 18°N and on the south by latitude 16°N. Luzon would be covered by a wider strip from latitude 19°N to latitude 15°N.

The success of this compilation work would rest heavily on contributions of geoscientists in the U.S. and other countries. Closer co-ordination with J. Curray and D.E. Hayes should ensure compilation of a well-prepared synthesis for the transect.

Progress of Activities along Transect VIII

Activities on transect VIII included seismic data compilation in the South China Sea - Palawan - Sulu Sea - Celebes Sea areas. Seismic data gathered by the R.V. SONNE and R.V. EXPLORA in the South China and Southwest Sulu Sea areas were included in that compilation. The Seismic compilation and tectonic interpretations were published in a paper by Hinz K., et al. (1985) entitled "The southern Palawan-Balabac Area: An Accreted or Non-Accreted Terrane?".

Onshore geological data on central Palawan were updated by previous mapping undertaken by the BMG-UNDP project. Results of that mapping are contained in a paper by Mitchell, A.H.G. (1984) entitled "Cenozoic Evolution of the Philippine Archipelago".

The east-west Sagihe and Molucca Sea Segment of Transect VIII will be co-ordinated with Mr. Untung of Indonesia, and Dr. G. Moore of the University of Ohio.

1985 Work Undertaken and Planned on Transect IX

Work undertaken in 1985:

1. Dr. H.L. Davies is presently compiling a 1:1 000 000 geological map of western Papua New Guinea from 141°E - 144°E.

2. Geological mapping/mineral exploration by the Geological Survey undertaken in Sepik headwaters area, continued in 1985. Work consisted of helicopter supported 1:100 000 geological mapping and systematic stream sediment sampling. Two new 1:100 000 maps covering medium to high grade parts of the foreland fold/thrust belt have been compiled in the last two years. Geochemical atlases are also being produced which summarize 2 500 partial and total extraction geochemical analyses for Cu, Zn, Co, Ag, As - 80 mesh stream sediment analyses.

3. An airborne geophysics team supplied and largely funded by Federal Republic of Germany aid money is participating in a joint BGR/Geological Survey of PNG aeromagnetic and aeroradiometrics survey in the south Sepik area. Follow-up ground geophysics will be carried out in 1986.

4. Dr. C. Klootwyk undertook laboratory studies on samples collected during joint BMR/Geological Survey of PNG fieldwork in the Sepik River area in 1984.

5. First drafts of the 1:1 000 000 maps of the Transect IX atlas were compiled.

Work planned in 1986:

1. Dr. H.L. Davies should complete his 1:1 000 000 map of western PNG.

2. The Geological Survey will complete field work and laboratory studies associated with 1:100 000 mapping/mineral area and produce final geological and geochemical anomaly maps and reports.

3. Field work will be undertaken by the Geological Survey in the Aitape Wewac block north of the Sepik area to resolve stratigraphic and structural problems in the area.

4. Ground follow-up of anomalies uncovered by the airborned magnetics and radiometrics survey will be undertaken.

5. A research cruise by the MOANA WAVE in the Bismarck Sea will take place in December 1985-early January 1986. This cruise should resolve opening geometry of the Bismarck Sea and its age.

6. Compilation of transect maps and profiles will be completed.

Work Undertaken and Planned on Transect X

1985

1. Geological Survey staff and consultants participated in a major compilation of geological and geophysical data to review petroleum potential of the Cape Vogel, Bougainville and New Ireland Basins.

2. Field work was completed on New Ireland by the Geological Survey to resolve conflicts between the interpretation of non-marine and marine geology of the New Ireland Basin.

3. A major review and re-interpretation of the geology and mineralization on Woodlark Island was completed and published by the Geological Survey.

4. First drafts of the 1:1 000 000 base maps (including bathymetry and topographic contours) for Transect X were compiled.

5. Officers of the Geological Survey, and North Solomons Provincial Government held meetings with land-holders on Bougainville Island in an attempt to resolve opposition the latter have to any mineral exploration on the island. Since 1972, a mineral-petroleum exploration moratorium has existed on Bougainville Island.

6. The Australian Bureau of Mineral Resources research vessel RIG SEISMIC is presently conducting marine geophysical/geological studies in the Coral Sea.

Work planned for 1986.

1. Completion and publication of New Ireland geology and petroleum potential project results.

2. Dr. H.L. Davies should complete compiling and publish the Buna and Salamaua 1:250 000 geological map and explanatory notes.

3. After completing their survey in the Sepik River area, the Federal Republic of Germany airborne geophysics team will move to Bougainville late in 1985, to start an airborne magnetics and radiometrics survey of that island. The survey will be conducted early in 1986.

4. Early in 1987, it is hoped that local opposition to mineral exploration on Bougainville will have decreased so that 1:100 000 regional mapping/mineral exploration can be undertaken by the Geological Survey. At the same time, ground follow-up will take place of aeromagnetic and aero-radiometric anomalies

discovered by the Federal Republic of Germany airborne geophysics team.

5. Compilation of transect maps and profiles will be completed.

Report on Work in South China Sea

Dr. D. Hayes reported that the South China Sea co-operative programme between the South China Sea Headquarters and Lamont-Doherty Geological Observatory was currently in progress. About 2 000 km of wide aperture, two ship seismic data and 12 expanding ship profiles (ESP) have already been completed and work is continuing. The results of this work will be relevant to the ongoing studies of transects I, V, VII. The field programme will continue aboard the R.V. ROBERT D. CONRAD through the end of 1985 and it appears that the entire programme of proposed work will be completed.

Dr. Hayes acknowledged the important contribution of CCOP in helping to ensure that this programme could be implemented. Preliminary results of the joint programme should be available for presentation at the next SEATAR Working Group Meeting.

ANNEX V

PROPOSED REVISED TERMS OF REFERENCE FOR SEATAR

1. To act as joint mechanism for co-operation between CCOP and its Programme Group for the Western Pacific (WESTPAC) in the field of marine geoscience, tectonics and resources.

2. To promote and co-ordinate the implementation of agreed projects with particular attention to those parts of the IOC-UN (OETB) programme of Ocean Sciences in Relation to Non-Living Resources relevant to CCOP and IOC (WESTPAC).

3. To evaluate and assess the results of projects contained in the programme of research as they become available.

4. To ensure the continued updating of the programme of research in the light of the above-mentioned evaluation and assessment.

5. To facilitate exchange of data collected, with due attention to the mechanism available in the IODE, and to ensure dissemination of the scientific results.

6. To assess the scientific needs of the participating States in the region on a continuous basis.

7. To provide advice to participating States on the development of their capabilities and facilities for the projects, with due attention to the guidance available from the IOC Working Committee for Training, Education and Mutual Assistance in the Marine Sciences (TEMA).

ANNEX VI

LIST OF ACRONYMS

AAPG	American Association of Petroleum Geologists
BGS	British Geological Survey
CCOP	Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas
CPMP	Circum Pacific Map Project
ESCAP	Economic and Social Commission for Asia and the Pacific
IBC	International Bathymetric Chart
IDOE	International Decade of Ocean Exploration
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data Exchange
IPOD	International Phase of Ocean Drilling
IUGS	International Union of Geological Sciences
OSNLR	Ocean Sciences in Relation to Non-Living Resources
PNG	Papua New Guinea
SEATAR	Joint CCOP-IOC Working Group on post IDOE Studies on East Asia Tectonics and Resources
SFZ	Sumatra Fault Zone
TEMA	Training, Education and Mutual Assistance in the Marine Sciences
UNDP	United Nations Development Programme
WESTPAC	Programme Group for the Western Pacific Region