

EXECUTIVE SUMMARY
JOIDES TECTONICS PANEL MEETING
CORVALLIS, OREGON
15-18 MARCH 1988

88-120
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Western Pacific

a. Celebes/Sulu

The goals of dating the basement of the Celebes and Sulu basins are of broad tectonic interest. Sites CS-1 and SS-1 address these goals, but Site SS4 is extraneous.

b. Geochemical reference sites

The Panel suggests sites (3-4 minimum) that can also address tectonic targets (Jurassic Quiet Zone and M-Series Dating, see Appendix to Minutes).

c. 1. Nankai second leg

- the overall plan clearly addresses important thematic objectives. TECP sees the need, however, to review a more detailed proposal with more clearly defined objectives illustrated by clear seismic sections.

2. Zenisu Ridge

- views unchanged, TECP still questions uniqueness of site and dateability.

3. ¹⁰Be reference site

- is not viewed as contributing significantly to TECP goals.

4. Aoba (Vanuatu) intra-arc basin

- immature.

5. Self-boring pressureometer

- To be encouraged but premature.

6. Japan Sea bore hole seismometer (Proposal 155F)

- endorsed in principle but with questions about specifics and trade-off with down hole time needed.

7. Japan Trench-Nankai Trough Melange (Proposal 281D)

- interesting but not thematically compelling.

d. South China Sea Margin (Proposal 46D second revision)

TECP is split (6 yes, 3 no, 3 abstain) on the thematic importance of drilling the South China Sea margin, but still willing to consider again the question of whether this is an important opportunity to further understanding of passive margins. There is also virtually unanimous disquiet about accepting 46D as it stands.

e. Lau Basin

TECP remains broadly interested in the program of Lau Basin drilling but does not strongly support a one hole fore-arc program.

Central and Eastern Pacific

a. TECP confirmed its top 5 thematic takings for CEPAC:

1. M-Series dating
2. Lithosphere flexure
3. Ridge-trench interaction
4. Pre-70 Ma plate motions
5. Deformation in accretionary prisms

The Panel suggests that Themes 1 and 4 can be addressed in relation to geochemical reference hole drilling (see above). Themes 2 and 3 await, respectively, an analysis of dating problems and detailed site information. At present the most interesting proposal for Theme 5 involves fluid circulation studies.

- b. 1. Behavior of accreted and basinal sediments (Proposal 299F)
- of thematic interest but immature.
2. Marquesas moat (Proposal 291E)
- very high thematic interest but lacks supporting data.

Miscellaneous Proposals

- a. Stresses in oceanic crust (Proposal 66F revised)
- immature, a contribution to future planning.
- b. Antarctic Peninsula margin (Proposal 297C)
- high thematic interest but requires more data.
- c. Ross Sea (Proposal 296C)
- of interest particularly in interaction between tectonic and paleoenvironmental themes.

Planning

TECP White Paper on Global Themes for ODP will emphasize tectonic processes, particularly active ones. The White Paper will strongly emphasize measurement of parameters of tectonic significance and interaction with other programs. Priority topics (not ranked) are:

1. Plate kinematics - past and present
2. Dynamics of the lithosphere
3. Structure of deep crust and mantle
4. Rifted margin processes
5. Convergent margin processes

Target date: Submission to JOIDES Journal 9-1-88

D R A F T

**JOIDES TECTONICS PANEL MEETING
CORVALLIS, OREGON
15-18 MARCH 1988**

Panel Members Present:

Ian Dalziel (USA) Chairman
Roger Buck (USA)
Dan Davis (USA)
David Engebretson (USA)
Karl Hinz (FRG)
David Howell (USA)
Kenneth Hsü (ESF)
Robin Riddihough (Canada)
François Roure (France)
Peter Vogt (USA)
Graham Westbrook (UK)

In Attendance:

Greg Moore (WPAC)
Nick Piasias (PCOM)
Tom Shipley (PCOM)
Kensaku Tamaki (Temporary TECP replacement for Nakamura,
Japan)

A G E N D A

1. Preliminary introductions
2. Minutes of previous meeting
3. Chairman's remarks and up-date
4. Report from PCOM Chairman
5. Discussion of agenda
6. Report from liaisons (1)
7. Western Pacific (including proposal reviews)
8. Report from liaisons (2)
9. Central and eastern Pacific (including proposal reviews)
10. Miscellaneous proposal reviews
11. Long-range planning
12. Next meeting

MINUTES

Tuesday, March 15, 1988

1. New Chairman, Dalziel, welcomed new members Roger Buck and David Engebretson. Dan Davis kindly agreed to act as recorder for the Chairman.

2. Minutes of Previous Meeting

Graham Westbrook noted that in the Executive Summary Section 2B Nankai the word "fluid" was missing before the word "composition". With this change, the minutes were unanimously adopted.

3. Report from PCOM

PCOM Chairman Piasias reported plans for FY 89:

| | |
|----------|-----------------------------------|
| Leg 124 | Banda (Co-chiefs Hinz and Silver) |
| Leg 124E | Engineering test leg |
| Leg 125 | Marianas |
| Leg 127 | Nankai |
| Leg 128 | Japan Sea I |
| Leg 129 | Japan Sea II |

and for FY 90:

Four legs pretty well set --
South China Sea Margin
Vanuatu
NE Australian Margin
Lau Basin
Three legs less well defined --
Geochemical reference
Nankai geotechnical
Banda-Sulu

For "planning purposes" Pacific Ocean was allocated 3 years. WPAC had 11 very strong programs and therefore went to 22 months; CEPAC has tentatively been assigned 18 months.

Present allocation of 9 CEPAC legs:

LITHP 4
SOHP 3
TECP 2 Flexure of Lithosphere and Chile Triple Junction

PCOM Chairman has asked TECP to comment on this and to designate a third topic as a back-up "tectonic leg"

Changes in Panel structure were discussed. TECP is to be maintained as one unified body.

Safety problems were reported with regard to Exmouth Plateau drilling.

Budget projections to 1992 (\$40M) were reviewed.

4. Indian Ocean

Proposal Review

The proposal to return to Site 735B on the SW Indian Ocean Ridge was reviewed (Proposal 300B). Several questions were raised:

- How adequate was the original site survey?
- The survey still seems inadequate and insufficiently documented (particularly seismic reflection regarding nature of possible Moho reflection).
- Is the site really on "normal" oceanic crust (i.e., generated at the ridge)?
- What is the nature of the foliation on which the supposed listric normal fault interpretation is based and on which the comparison with St. Paul's Rocks is made?
- What other leg would need to be dropped? (Nankai cannot slip due to typhoon season).
- Reflector alluded to could be intracrustal, there are known culminations and depressions in magma chamber roofs along the strike of ridges.

Summary of Views: While drilling through Moho is not a stated objective of TECP it is of course an exciting prospect. The Panel is, however, unconvinced that there is a well established case that Moho can be reached at 735B and that the latter is not in an anomalous area. There is a serious need for survey data.

Motion -- TECP, for reasons stated, does not support an immediate return to 735B on the basis of the proposal submitted.

Vote in favor -- 11-0 with 1 absention.

5. Western Pacific

Question of Co-chiefs for WPAC legs was not discussed as PCOM Chairman had informed TECP Chairman that the necessary decisions had been made.

5.1 WPAC liaison, Greg Moore, reported. The comments of TECP were solicited particularly on Lau fore arc drilling and proposed Japan Sea bore hole seismometer.

5.2 Proposal Reviews:

After initial discussion of South China Sea drilling it was decided to postpone detailed discussion until after a review of the regional tectonic setting as reflected in proposals for Sulu and Celebes sites.

- a. Karl Hinz (proponent) reviewed Proposals 292E and 293E.

Consensus (reached in absence of K. Hinz): The goals of dating the basement of the Celebes and Sulu basins is indeed of broad tectonic significance in understanding the geodynamics of SE Asia and the Panel supports them. Sites CS-1 and SS-1 do address these goals directly and should be drilled although there is need for more precise information on location (with respect to transform faults for example). Site SS-4 is tectonically exciting but extraneous to the main goal of the leg in question and could dilute seriously the efforts made in that direction. The Panel would be favorably disposed towards the drilling of a site for dating the inception of spreading in the southwestern South China Sea but is not satisfied with the data presented so far in support of SCS 5.

- b. In response to PCOM's request for comments on tectonic objectives that could be addressed while drilling Geochemical Reference Holes, Peter Vogt presented an analysis of Proposal 267F (See Appendix 1).

Consensus: It appears that drilling as proposed in 267F can address requirements of Jurassic Quiet Zone and M-Series drilling (285E, 287E) while also acquiring the necessary material for geochemical reference. A minimum of 4 sites are required to meet the TECP goals.

Wednesday, March 16, 1988

c. Nankai drilling (Proposals 295D, 301D)

While broadly endorsing the goals of a second Nankai leg, the Panel emphasized the need for more documentation of the sites, particularly NKT 3 and NKT 5. Interpretations of the JAPEx line on which these sites are located in another proposal (see 281D below) raised additional questions about their significance. The need for the revised second Nankai leg proposals to be reviewed by the thematic panel as well as by WPAC was emphasized.

With regard to Proposals 298F and 155F, we believe that vertical seismic profiling is essential at sites such as those in the Nankai prism (298F) in order to obtain *in situ* velocity data, but the bore hole observatory proposal (155F) is more problematical. The Panel endorses it theoretically but has concern about the effects of currents on the reentry cone, of sea bottom and sea surface reflections, and of drilling disruptions on core stress considerations. What are the expected improvements in resolution anticipated from deployment of a bore hole instrument, and how long will data be recorded to compensate for the time expended in deployment?

Our views on Proposal 177D (Zenisu Ridge) are unchanged: The important point is not the thrust itself but the timing. We still question the uniqueness of the site and the dateability.

The proposal for a ^{10}Be ocean reference site (Proposal 289E) is not viewed as contributing significantly to our accretionary wedge mass balance concerns. We are not convinced that new sites are needed off the high ^{10}Be area of the arc.

The proposal for drilling in the Aoba intra-arc basin (Proposal 294D) to study ophiolite emplacement is immature. The copy we received does not have a well documented case for the drilling. In particular it lacks site data and makes us uncertain that the target can even be reached in the basin.

The proposal for a self-boring pressure meter (Proposal 299F) is interesting. We strongly encourage the development of tools like this for a variety of settings (not just Cascadia), but the proposal is premature in terms of development of the tool and possible deployment.

Consensus on Nankai Transect (Proposals 295D, 298F, 301D). The Panel addressed the question of whether a second Nankai leg is warranted within the framework of the above proposals, particularly 301D that provides an overview of the planned drilling. It was concluded that the plan does clearly address thematic objectives. Nankai is a well studied margin and a good "counterpoint" to the Barbados fore arc. There is, however, real need to come back to TECP, in addition to WPAC, with better data (i.e., seismic lines) and more clearly defined objectives, and answers to some important questions:

- Is there a major problem with BSRs and gas hydrates?
- How are the main sites located structurally on the profile?

- Is there a problem with sea mount collision (see Proposal 281D)?
- Is NKT1 far enough to seaward?
- Is NKT 3 on a thrust or merely a fold?
- What are exact goals of NKT5?
- What type of tools (e.g., packers, etc.) will be used?
- What about hole stability in a sandy section?

Overall TECP would like to see a better constrained program better illustrated on a seismic section.

- d. TECP had a long discussion on the question of drilling the South China Sea margin (Proposal 46/D second revision). While recognizing that the proponents had considerably improved the overall rationale of the proposal there is still considerable disquiet about the overall goals. Finally the Question "Do we support the concept of drilling the South China Sea margin" received 6 "Yes" votes to 3 "No" votes, with 3 abstentions. On the Question "Do we endorse the double-revised Proposal 46D as it stands", TECP voted 0 "Yes", 8 "No" and 4 abstentions.

Consensus: These votes be conveyed to proponents with information that K. Hsü and K. Hinz are available (with TECP Chairman) for discussion. Half the Panel support the concept but there is still unanimous disquiet about accepting the proposal (46/D) as it stands.

Typical concerns centered around lack of certainty about the plate and kinematic setting (e.g., relationship to India-Asia "extrusion" tectonics) and the marginal basin setting (a "plus" to some and a "minus" to others).

At least two major concerns expressed at the previous TECP meeting went unheeded:

- Could two or even one hole not satisfactorily discriminate between different models?
 - Proposed transect should not cross the extension of an inferred transform fault, albeit one of limited offset.
- e. Proposal 281D (Japan Trench-Nankai Trough) is an interesting suggestion addressing an interesting problem but it is short on data as a proposal and expresses a doubtful idea for making volumetrically important melange material.

Consensus: An interesting problem but we do not see a clear idea of where it can be done properly and of what the drill will teach us.

- f. Lau Basin

Consensus (as before): We remain broadly tectonically interested in the program of Lau Basin drilling but remain of the opinion that one hole in the fore

arc during a program designed to mainly address the volcanic history is not going to prove of outstanding tectonic interest.

6. Central and Eastern Pacific

- 6.1 The Panel reviewed the ranking of CEPAC drilling themes arrived at during the September 1987 meeting in Celerina. It reaffirmed its intense interest in the top 5 themes but did not wish to devote any of the others to a higher status although noting that some might be drilled as peripheral to other projects.

Thus in response to PCOM's question of TECP's ranking in CEPAC, we strongly urge that PCOM plan a drilling program that addresses all of the following themes:

1. M-series dating
2. Lithosphere flexure
3. Ridge-trench interaction
4. Pre-70 Ma plate motions
5. Deformation in accretionary prisms

The Panel took note of PCOM's letter concerning TECP priorities and the fact that PCOM specifically requested:

- a. Comment on the assignment of items 2 and 3 above as the target of specific tectonic legs in a CEPAC drilling program; and
- b. Identification of an alternative topic for a "tectonic leg". Rather than follow this line of thinking TECP prefers to restate the reasons for continuing to regard the above 5 themes as being of the highest tectonic priority for CEPAC drilling, and to suggest that at least 3 of them are of broad interest and should be planned in the context of multipurpose legs.

M-Series Dating and Pre-70Ma Motion

TECP restates the vital importance of these topics for the earth sciences in general. They represent critical constraints on the overall reference frame of plate tectonics and have major importance for sea level changes, the orogenic and magmatic history of continental margins, and almost all tectonic problems of a global scope.

These two themes can be addressed in a program to drill in the western Pacific for geochemical reference sites and the appendix by Peter Vogt (see also section 5b) analyzes such a program. TECP is also requesting CEPAC to re-evaluate Proposal 280/E in this regard.

Lithospheric Flexure

TECP still believes the study of flexure in the oceanic lithosphere is of the highest priority. Of the two proposals to address this problem (3E and 291/E) the former (Hawaiian moat) is preferable in the sense that the setting is "cleaner" (i.e., away from fracture zones). What is urgently needed is an analysis by the proponents of how the main thrust of the proposals is affected by the likely difficulty in obtaining dating for the past 2-1/2 million years at a satisfactory resolution. The Panel understands that D. V. Kent has analyzed the situation from the dating point of

view for SOHP. The proponents need to "get back" as soon as possible on this one.

TECP notes that this theme is on the list of global thematic priorities in the LITHP White Paper and is therefore not of thematic interest solely to TECP as indicated by PCOM.

Ridge-Trench Interaction

TECP continues to regard this theme very highly. An up-date by Graham Westbrook of Steve Cande's recent R/V *Robert D. Conrad* cruise at the Chile rise-trench triple junction (for Site Survey in connection with Proposal 8E) gives grounds for optimism that suitable drill sites for addressing the main tectonic issues will be identified once MCS data are processed. The proponent is urged to get a revised proposal submitted as soon as possible.

Deformation in Accretionary Prisms

While the results for the Nankai Trough drilling will influence to some extent plans for future accretionary prism drilling, it is clear that the eastern Pacific offers many opportunities to pursue the important goal of understanding tectonic accretion (and erosion) at convergent margins:

Vancouver margin to penetrate the décollement and investigate underplating (237E at 1.5 km); Oregon margin (233E) for hydrogeologic investigations; Andean margin (8E) for erosional, trench-ridge and trench-fracture zone interactions, Cascadia (277E) for aseismic slip -- to name but a few. The hydrogeology objectives for the Oregon margin are of greatest immediate interest the TECP given the importance of fluid circulation at convergent margins.

6.2 Proposal Reviews

Proposal 224E Drilling on the Escanaba Trough/Gorda Rise was not rated as being of high thematic interest to TECP.

Proposal 299F To study the behavior of accreted and basinal sediments was rated as being of thematic interest but is immature.

Proposal 291E To study the most of the Marquesas Island chain is of very high thematic interest (see Section 6.1) but the tectonic setting of the Marquesas chain is not as well known as that of the Hawaiian chain. Also the proposal lacks supporting geophysical data.

7. Miscellaneous Proposals

Proposal 66/F (Revised) to measure principal stresses in the oceanic crust is of high thematic interest. It clearly meets objectives stressed by COSOD II and should be considered with other proposals in considering how to proceed with *in situ* stress measurements. There appear to be problems with regard to core orientation measurements.

Proposal 297/C for studies related to ridge/trench interaction along the Antarctic Peninsula margin is of high thematic interest to TECP. The evidence of uplift is not, however, clear to all Panel members and the "drillability" and "dateability" of the glaciogenic(?) sedimentary apron are of considerable concern. The proponents are encouraged to resubmit addressing these questions as well as supplying additional data (many seismic lines are now available from this margin).

Proposal 296/C for drilling in the Ross Sea area was judged to have its main value in the interface between tectonic and paleoenvironmental themes rather than on the tectonic themes alone. Most of the tectonic themes can be addressed in other parts of the world. TECP is very sympathetic to this proposal as one with very broad interest. More information on the tectonic objectives (e.g., uplift of the Transantarctic Mountains) and how they would be addressed by the drill is needed from the proponents. The proposal is recommended for SOHP consideration in particular because of its Antarctic ice/climate implications.

Thursday, March 17, 1988

8. Medium-Long Range Planning ("beyond CEPAC")

The Panel spent the whole day on broad discussions of priorities for future tectonic drilling in the light of the COSOD II Report, especially the recommendations of Working Group 3 (Fluid Circulation) and Working Group 4 (Stress and Deformation in the Lithosphere). It was agreed that the TECP White Paper on Global Thematic Priorities should be based on the following:

Goal To identify major problems related to tectonic processes that ocean drilling should be addressing, and to develop recommendations on the drilling strategies and technical development required to carry out this drilling.

Background Prepared after COSOD II and reflecting the Tectonic Panel's view of how ODP should move forward addressing the main tectonic problems identified therein as well as others the Panel regards as being of pressing importance to understanding the tectonic evolution of the continents and ocean basins.

Emphasis Tectonic processes, particularly active processes only addressable with the drill at sea.

New Thrusts

Measurements of parameters of tectonic significance

Interaction with other major programs in the earth sciences.

Priority Topics (not ranked)

- Kinematics of present and past plate motion.
- Dynamics of the lithosphere.
 - a. Interplate stresses and the driving forces.
 - b. Plate boundary stresses and deformation.
- Structure of the deep crust and of the mantle.
- Processes leading to the development of rifted continental margins.
- Processes at convergent plate boundaries.

It was acknowledged that there is need to interact with others (for example Workshop Convenors) in preparing the White Paper. The goal is to have a first draft prepared by mid-June 1988 and the final version ready for the JOIDES Journal by September 1, 1988.

9. Next Meeting

The next meeting of the Tectonics Panel will be in Hannover, West Germany, during the week of October 3-7, 1988 subject to PCOM approval.

Geochemical Reference Holes on old Pacific crust east of the
Marianas/Bonins arcs:

Positioning of Drill-sites to satisfy "M-Series Dating",
"Magnetic Amplitude Variation", and "Jurassic Quiet Zone"
objectives

P. Vogt (3-14-88)

(1) According to its 14 Dec 87 letter to TECP,

"PCOM is considering drilling "Geochemical Reference" holes for the Bonins and Marianas. As proposed by LITHP, this would require one and a half legs of drilling. It is possible that this drilling can also address objectives of "M-Series Dating" and "Old Pacific Drilling". PCOM would like your input as to the positioning of proposed geochemical reference holes (Proposal 267/F) in the Bonin and Marianas area which can also address other tectonic issues."

(2) TECP should enthusiastically (a) endorse these "Geochemical Reference Holes", (b) suggest that at least two complete legs be devoted to them, and (c) provide PCOM with sites which provide the geochemical reference holes (as defined in 267/F) while achieving the objectives of "M-Series Dating" and "Old Pacific Drilling". (The latter is here equated with crust of the Jurassic Magnetic Quiet Zone (JMQR), nominally everything older than anomaly M-25).

In its tentative 18-month drilling program for the eastern and central Pacific (14 Dec 87 letter) PCOM excluded any M-Series/Old Pacific drilling, even though these topics were highly ranked by TECP and satisfy various LITHP and SOHP objectives. So, the geochemical reference holes seem to be the only opportunity to address M-Series/Old Pacific problems.

3. Following are the pertinent recommendations of 267/F:

^a (a) "Because the integrated crustal alteration history of fast-spreading crust has never been investigated through drilling, we propose that a major multiple re-entry hole be drilled on an identifiable M-Series magnetic anomaly in the western Pacific, that this hole be drilled to 500m depth into basement, and that a full logging/seismic program be devoted to study of such a hole.

(b) To relate the compositions of subducted sediment and ocean crust to arc systems that will be subject to multi-leg drilling efforts in the western Pacific, we propose drilling at

least five single-bit holes through the sediments into ocean crust up to bit destruction, east of the Bonin and Mariana arcs. The five targets are necessary to investigate the range of materials being subducted and to have holes in front of both these geochemically distinct arcs. The holes would be: (1) one hole for each arc drilled into ocean crust away from incoming seamounts and through a pelagic sediment cover; (2) one hole for each arc drilled into distal portions of volcanoclastic aprons derived from large seamounts, which make up an important component of the Pacific plate in this region; (3) one hole placed on the summit of a seamount, to be drilled through its sediment cap and well into basement. This sequence of holes should provide some sampling of each principal component involved in subduction, and a series of shallow basement composition to compare with the deep multiple re-entry hole put into Pacific crust nearby. These holes could also provide significant regional information concerning the history of western Pacific ocean crust, seamounts, and Cretaceous paleoceanography.)

Obviously, there would be distinct advantages to combining the deep penetration objectives with the arc-specific objectives, and one of the single-bit holes could also be the deep hole. Although we believe that a single package encompassing all these objectives would have the greatest scientific benefit, we consider that the regional (arc-related) objectives could be accomplished with the suite of single-bit holes, and that there could be flexibility in assigning the location of the deep site. In view of logistical considerations (ship track, ease of return site, regional priorities) this is an important consideration. For these reasons, the re-entry site could be physically remote from the Bonin/Mariana arcs if necessary, but it should be within the M-Series magnetic lineations that characterize the spreading rates and general crustal history of material now being subducted in the western Pacific.

4. Seamount/apron Objective: PCOM has already assigned 1 leg to the "Ogasawara Plateau" (260/F) located seaward of the southern Bonin arc. The "Ogasawara Plateau" drilling includes guyots (seamounts), a broader aseismic ridge, and archipelagic aprons. This satisfies the "seamount" and "apron" geochemical reference hole objective for the Bonin arc.

In addition PCOM endorsed proposals 202/E (Drowned Marshall guyots) and 203/E (Central Pacific guyots) which although unsatisfactory for the purpose of dating Mesozoic Pacific hotspot traces should also provide geochemical reference hole information - particularly if the ages and compositions turn out to be similar to the Ogasawara Plateau edifices.

Note however that 202/E, 203/E, and 260/F all target large edifices. It may be that these are volumetrically and compositionally most important for the down-going slab's contribution (if any) to the arc magmas. However, the far more

numerous smaller edifices are not represented in these proposals, raising the possibility of biased sampling. (Proposal 280/E, "Drilling the Cretaceous-aged Geisha seamounts and Guyots in the Western Pacific" did include smaller edifices but his proposal did not meet PCOM approval).

As regards the Marianas arc, there are two guyot/seamount complexes, the Dutton and the Magellan seamount clusters, conveniently situated not far east of the Marianas Trench. U.S. Navy multibeam data are published for the Dutton seamounts and will soon be available for the Magellan seamounts. A drillsite on the summit of one or more guyots would satisfy the "Geochemical Reference Hole" objective while providing valuable sea level/carbonate bank/guyot formation data for the eastern end of the Mesozoic guyot province. The authors of proposal 280/F would be willing to write a proposal for the Dutton/Magellan edifices if there is a reasonable chance the sites will be accepted.

It is possible that the "archipelagic apron" sampling could be combined with Old Pacific crustal sampling (Sites 1, 2, 3, and 6 of proposal 285/E, "Jurassic Quiet Zone, Western Pacific") if the crustal sites are situated to sample the thinner, distal portions of the aprons on their way to basement.

(5) Basement Sampling: In situating drill-sites to sample what is being subducted under the Marianas-Bonin arcs, attention should be focussed on the geometry of crustal isochrons and fracture zones seaward of the arc. The age of the crust presently entering the Bonin Trench ranges from about M-20 (Tithonian) to M-10 (Hauterivian). The age of the crust presently entering the Marianas Trench ranges from about M-20 in the north to pre-anomaly 29 (Callovian-Bathonian?) in the south. In general the crust gets older with increasing distance east of the trenches. Therefore the characteristics of the crust just entering the trench at any site is not identical (although probably close) to what has already been subducted.

From the general isochron pattern it is apparent that crust of the type already subducted at any point on the arc can still be sampled to the northeast where it has not yet arrived in the trench. For both, the geochemical reference hole and Old Pacific/M-Series sampling it is not critically important to place the drillsites immediately seaward of the trenches.

Although proposal 267/F did not mention fracture zones, they too should be sampled for Geochemical Reference Hole purposes. Note that fracture zones are not entering the Marianas and Bonin trenches at right angles as for the Aleutian arc. If arc volcanics are influenced by "fracture zone crust," perpendicular entry would provide a better test. However, if the average composition of the subducting crust is to be assessed, fracture zones cannot be left out, particularly for the Bonin arc where a

number of fracture zones are being subducted parallel to the trench.

Geochemical Reference Hole sampling east of the Bonin arc can be combined with M-Series dating and magnetic amplitude calibration (Proposal 287/E, "Deep Drilling in the M-Series, Western Pacific"). As a minimum, drillsites A2-1 and A2-3, both located on anomaly M-18 of the Japanese lineations, would establish the age of this chron and the difference in composition between the "high magnetic amplitude" crust. Whether the amplitude difference (a general feature of the M-Series in this region!) reflects a primary compositional or structural difference or a secondary difference related to differential alteration, this pair of drill-sites offers the opportunity to calibrate an easily measurable geophysical characteristic which can then be used to map crustal structure, composition, or alteration. One of the two sites should be chosen as the 500m deep site proposed in 267/F. The location is on a well-defined magnetic lineation, in an area well-mapped magnetically and bathymetrically, and having an age intermediate between the youngest crust subducted under the northern Bonin arc in the last 10 My, and the oldest crust subducted under the Marianas arc.

Several different candidates for sites for the old Pacific crust seaward of the Marianas arc could be chosen from sites JJ-1 through JJ-6 (Proposal 285/E). Each site has its own advantages, and the drilling of two sites is highly desirable.

Site JJ-5 will date what is probably the oldest Pacific crust, and is exciting from that viewpoint alone. Although this is older (perhaps by 10 to 20 m.y.) than crust subducted under the Marianas arc, basement composition will provide an end-member. (Probably there is little or no significant age-dependent difference between 150 and 170 Ma crust anyway).

Site JJ-3, on Handschumacher's "M-38", is valuable as a calibration tiepoint for the oldest recognizable magnetic lineation. A similarly aged site could be found in the area of JJ-6 based on the new anomaly identifications there (K. Tamaki, personal communication). a

© COMBINED W. GEOCHEM REF. SITE OBJECTIVES 260F, 285E
(267/F) 287'E

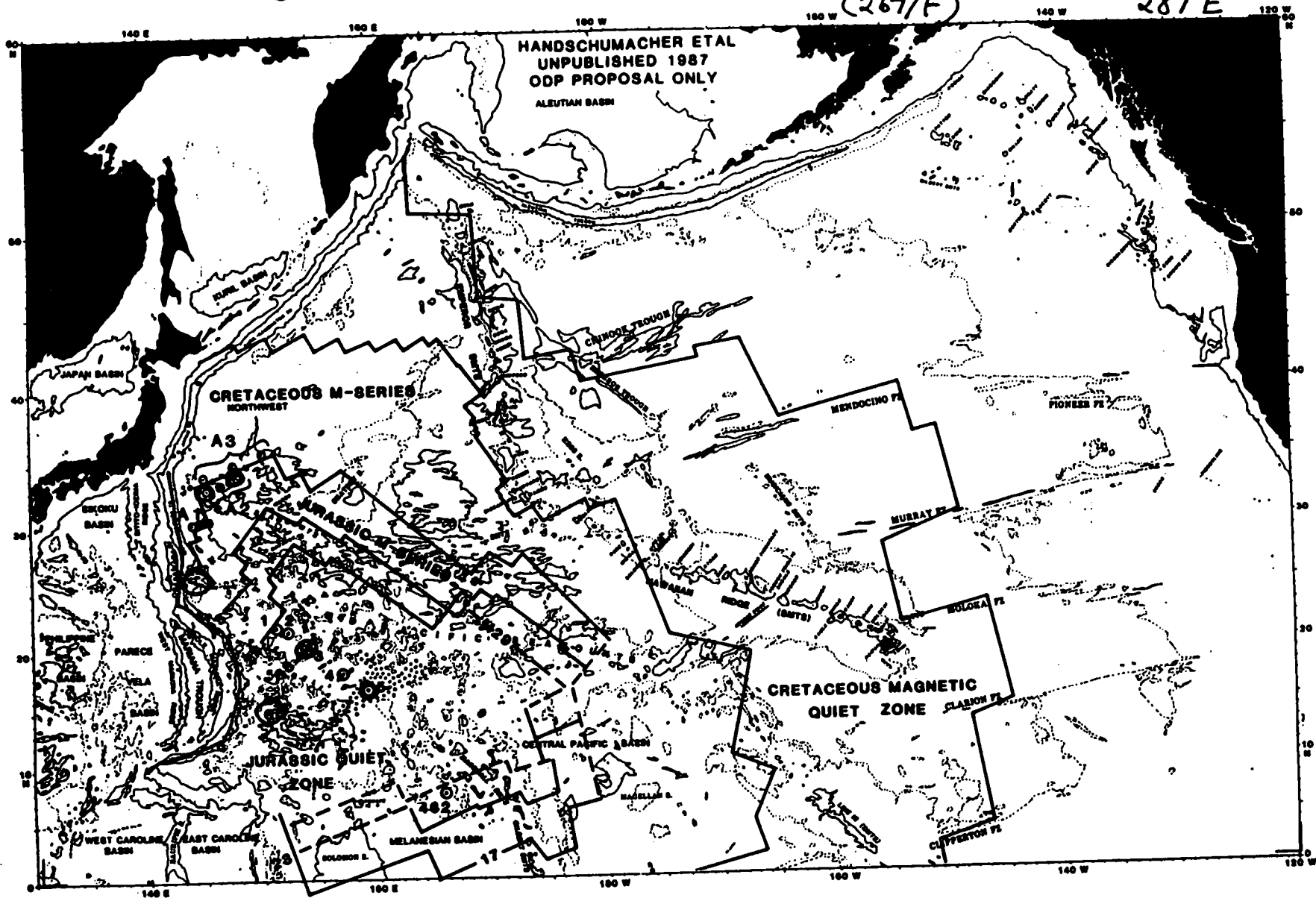


FIG. 1

④ COMBINED WITH GEOCHEM REF. SITE OBJECTIVES

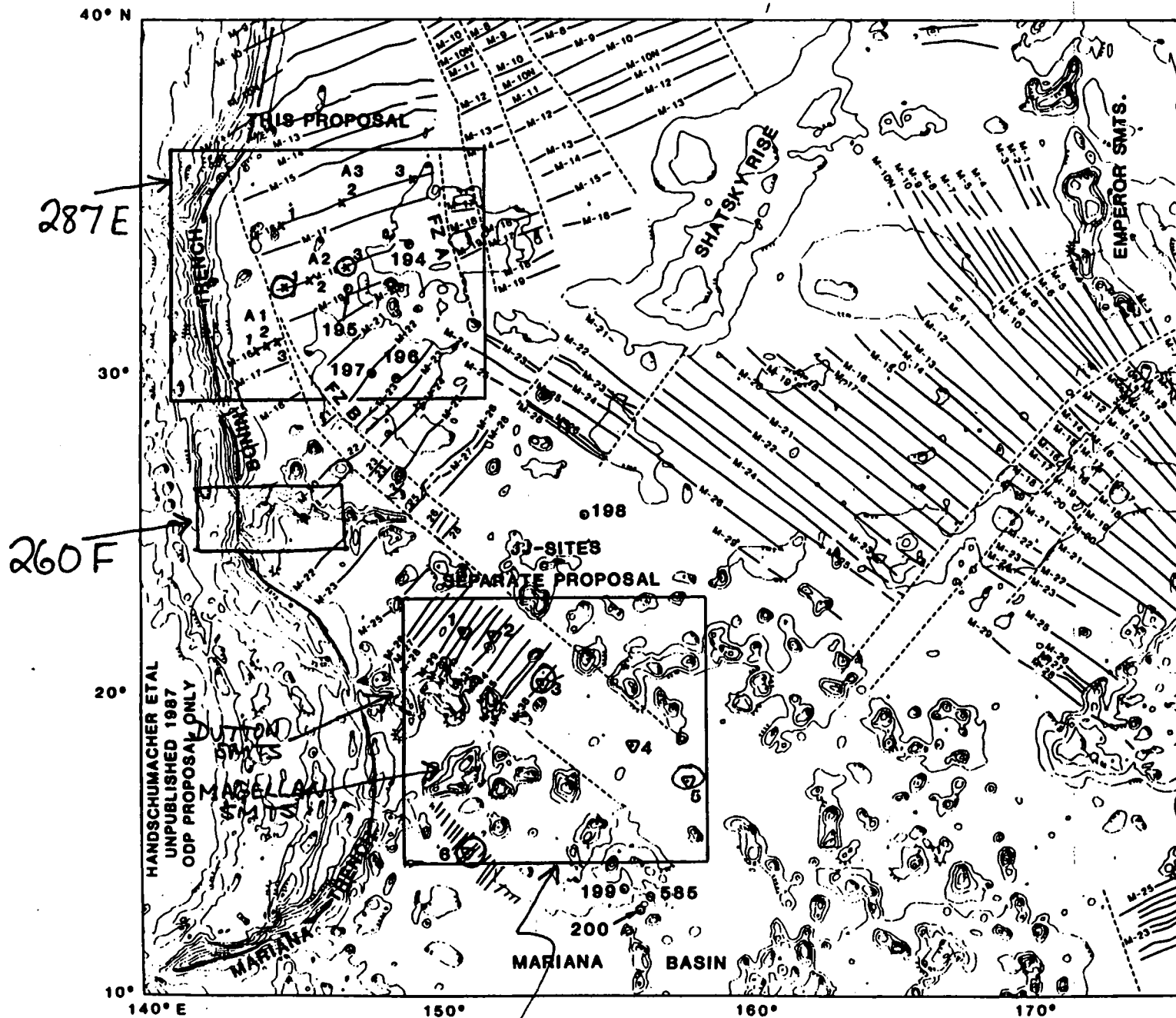


FIG. 2