IODP PPSP 1st Meeting Minutes
December 15-27, 2003
Nagasaki University and Nagasaki Prince Hotel
Nagasaki, Japan

PPSP Members Present:	Bob Bruce, Jiro Chinju, Akito Furutani, Hans Juvkam-Wold, Susumu Kato, Barry Katz (Chair), Jean Mascle, Toshi Matsuoka, Nobuo Morita, Craig Shipp, Dieter Strack, Manabu Tanahashi, Joel Watkins
Guests:	Jack Baldauf (TAMU/USIO), Colin Brett (ESO), Jim Channell (Proponent – Proposal 572), George Claypool (TAMU Safety Panel), Mike Coffin (SPC), Nobu Eguchi (SAS Office), Andy Fisher (Proponent – Proposal 545), Peter Flemings (Proponent - Proposal 589), Masaaki Fujishita (CDEX), Dave Goldberg (Lamont/USIO), Martin Hovland (TAMU Safety Panel), Hisao Ita (SPC), Masa Kinoshita (JAMSTEC), Ryuta Kitamura (JNOC-TRC), Toro Nishikawa (AESTO), Koji Ochiai (JNOC-TRC), Kyoko Okino (SSP), Daniel Quoidbach (ODP Databank), Michael Riedel (Proponent - Proposal 553), Carolyn Ruppel (NSF), Uko Suzuji (CDEX), Mariko Tanaka (AESTO), Masaoki Yamao (GODI)
PPSP Members Absent:	Tim Francis

The meeting was called to order at the University of Nagasaki by the chair at 8:30 on Monday, December 15th.

Nobuo Morita meeting host presented logistical details of the meeting and introduced Toro Nishikawa and Mariko Tanaka who assisted with meeting logistics.

Self introductions were performed and a sign-in sheet was passed among the participants.

Additional corrections to the past meeting minutes were solicited by the chair. None were forthcoming. The prior meeting's minutes were approved.

Jack Baldauf presented an overview of the JOI-TAMU-Lamont alliance as US operator for the riserless platform. A description of the responsibilities of each of the alliance members was presented along with the management scheme, which includes six different management teams. He also presented a brief overview of the last two legs of ODP – Leg 209 (Mid Atlantic Ridge) and Leg 210 (Newfoundland basin) and the demobilization of the *Joides Resolution*. The *Joides Resolution* will be used as the phase 1 ship for IODP, with the initial cruise tentatively planned to begin June 1, 2004. The first two expeditions will be to the Juan de Fuca Ridge and the North Atlantic. Both of these proposals will be reviewed at this PPSP meeting.

Nobu Eguchi presented the SAS meeting schedule through May of 2004. He then noted that there are 109 proposals in the system include the 5 that have been scheduled. Slightly more than half of the proposals fall under the environmental change theme, with solid earth cycles and deep biosphere having sub-equal submissions. The US scientists account for the majority of the lead proponents, but there are lead proponents from an additional 15 countries, with proponents coming from 35 nations. The SSEPs will continue to forward additional proposals to the SPC for ranking.

Uko Suzuki presented CDEX's status and 2004 plan. The shakedown cruise site survey will be completed during 2004. The shakedown cruise scheduled for 2006 will have four phases

1. System training aside the port;
2. Training for BOP / riser operation;
3. Deep water operation - without riser, water depth 5,000-7,000 m; and,
4. Shallow water drilling operation - riser drilling, water depth 1,000 m & 2,000 m, penetration 2,000 - 3,000 m

2004 will also include the first part of the site survey for international operations scheduled for 2006 pending the approval of a program by SPC. Other science (Center for Advanced Marine Core Research at Kochi University) and HSE issues were presented.

ACTION ITEM

- **Uko Suzuki and Barry Katz will determine PPSP's role in the Chikyu's shakedown cruise's safety review.**

Colin Brett representing ESO the MSP operator presented a status report of the Arctic drilling program. Drilling is scheduled for August-September 2004. They are currently finalizing contracts for the vessels. The drillship will need to be outfitted for the cruise, including the addition of the moonpool. The current plan is for 35 days ice-edge to ice-edge. This should permit approximately 15-20 days of actual drilling activity. There will be no provisions for the acquisition of new seismic for possible site relocation. The operator feels that there are sufficient number of locations and that the drilling time is so limited that there will be no need to review additional locations. Consequently PPSP will not need to provide a representative to scientific party.

The Chair and Kyoko Okino briefly discussed the status of Matrix. It was reported that the SPC felt that stating that the MATRIX presents requirements rather than recommendations was too strong a statement and that the working group should re-consider what are requirements and recommendations. A prototype web interface was presented at the last SSP meeting at Lamont. Since that meeting there has been little activity. This will be a discussion item at the next SSP meeting to be held in Tokyo (February 11-13).

ACTION ITEMS

PPSP members that are part of the MATRIX working group need to insure that the final report is completed in time for the March SPC meeting (March 22-26).

Masa Kinoshita presented a preview of Proposal 603 (Nankai Trough Seismogenic Zone or NanTroSEIZE). It was noted that there were three technical reasons backing the proposal it is an area with frequent significant seismic events that lead to Tsunamis with a heavily populated area, it is an accretionary complex where new land is being created, and significant amounts of methan hydrate exist and their resource potential is of interest. DSDP and ODP have previously drilled within the region, establishing some baseline information. The NanTroSEIZE is a Complex Drilling Project. There are several components:

1. An umbrella project
2. The collection of reference site data (this may include the placement of a CORK)
3. An examination of the mega-splay
4. An examination of the fault-boundary

These components equate to the following scientific and drilling program.

Phase 0: Geophysical/geologic characterization of the study area
Phase 1: Drilling and sampling of the incoming section and crust (includes 3 sites)
Phase 2: Drilling of the mega-splay fault to ~ 3500 m (includes 5 sites)
Phase 3: Drilling to the plate interface to ~ 6200 m (includes 1 site)

Safety issues raised by the proponent included:

- Clathrate and Hydrocarbon
- Man-made Hazards
- Kuroshio current
- Typhoon / Rough weather
- Anomolous formation pore pressure

Only the issues associated with clathrates, hydrocarbons and pore pressure are to be dealt with by PPSP the remaining issues are operator issues.

PPSP REQUESTS THE FOLLOWING ISSUES TO BE ADDRESSED PRIOR TO REVIEW

- **The distribution of shallow gas relative to the proposed drill sites (Shallow gas hazard survey will be required).**
- **An assessment of sea floor stability will need to be undertaken.**
- **Biologic activity of cold seeps and their relationship to the proposed drill sites.**
- **Abandonment procedures to be used to reduce the possibility of initiating a new seep.**
- **An assessment whether drilling could induce a major earthquake.**
- **Appropriate structure and/or isopach maps for key seismic events.**
- **An assessment of pore pressure.**
- **A review of prior drilling.**
- **Inclusion of acquisition parameters and processing scheme in the safety package.**

ACTION ITEM
Nobuo Morita will act as PPSP Watchdog.*

A brief discussion was held on the June meeting. The meeting will be held in College Station, hosted by Jack Baldauf, on June 21-22. Potential agenda items include a preview of the Storegga Slide Proposal, the results of the two e-reviews, coral reef drilling, and any additional items that may develop as a result of the remainder of the meeting and actions by the SPC.

Formal meeting was recessed at 12:00 (noon)

A tour of the *Chikyu* was conducted.

Meeting was reconvened at 8:30 on Tuesday, December 16th at the University of Nagasaki.

Mike Coffin presented a brief overview of SPC activities that relate to the business of PPSP. He noted that SPC was directed to assemble drilling programs for the next two fiscal years. This will permit PPSP to plan the main agenda items for its next several meetings. The working model for Complex Drilling Programs was also commented on noting that there will for each program be a scoping group, an implementation group, and an evaluation group. An Indus Fan scoping group has been assembled. It was also noted that discussions are underway with the Chinese to determine if they will participate in IODP. A brief discussion on panel membership and country representation was held.

ACTION ITEM
Barry Katz to arrange for a preview of the Indus Fan program.

Prior to the discussion on Proposal 589 a brief review of the conflict of interest rules was held. It was noted that Bob Bruce was a proponent for this proposal and was, therefore, conflicted. He will be permitted to participate in all discussions associated with the proposal but will not be a voting member of the panel when the final site-by-site reviews are held.

Peter Flemings presented a preview of Proposal 589 (Gulf of Mexico Overpressure). The program will examine fluid flow within a passive margin sequence. He discussed the hydrodynamics of overpressure, noting that the model was developed in a single dimension and that there was a clear need to be expanded to 2- and 3-dimensions. The results of this drilling program should provide information on:

1. What controls the stability of continental margins (mechanisms of landslides?
2. How do vents form?
3. How do we maintain a stable borehole in an over-pressured regime?

The proposed program is considered analogous to other drilling programs that have been conducted to examine fluid flow in accretionary prisms, and within mid-ocean ridges. The drilling experiment will test the hypothesis that flow is drawn into the base, focused, and expelled at the crest of permeable layers. This will be tested through an examination of the

* PPSP watchdog responsibilities are to maintain contact with the proponents, answer questions concerning the development of the safety package, and to insure that the requests of PPSP are conveyed to the proponents.

spatial variation in pressure, stress, and rock properties. Two end-members will be drilled. The first is a reference section in the Brazos-Trinity basin, which is turbidite rich, preventing the build-up of overpressure. No hydrocarbons have been recovered from the basin. In addition to the primary goal of this study a secondary goal will be the gathering of information on the development of the basin's turbidites. The reference section will be compared to that of the Ursa basin. The Ursa mini-basin has overpressure established within the upper ten's of meters. It is a major petroleum producing basin, with over 40 wells. No significant hydrocarbons are known to exist in the upper portion of the stratigraphic sequence. The hydrocarbons that have been recovered are biogenic. Venting is also known to exist within the region. Plans are to core first and then LWD. The piezoprobe will also be used. A CORK will be used for both immediate and long-term monitoring.

The review was presented in three parts: 1) Brazos-Trinity drilling; 2) drilling at Ursa above the Blue Sand; 3) drilling at Ursa into the Blue Sand. Flemings emphasized that the drilling at Brazos-Trinity and Ursa sites above the Blue Sand represented conditions commonly encountered in previous ODP drilling. In contrast drilling into the Blue Sand may require the use of weighted mud during drilling to hold back the flow of water and unconsolidated sand into the borehole. Flemings emphasized that while all three objectives would be ideal, meeting the first two of the three objectives would still achieve the majority of the science goals.

In closing, Bob Bruce presented an overview of "controlled riserless drilling". This procedure involves drilling with a weighted mud to hold back the formation pressure. It is suggested that this technique will be used while drilling into the Blue Sand.

PANEL REQUESTS NEEDED FOR FINAL REVIEW

1. **Relative amplitude seismic displays**
2. **A discussion on the planned mud program, including a statement of toxicity**
3. **An independent shallow gas assessment for both study areas**
4. **Near well logs, highlighting whatever data are available for the shallow sections**
5. **Proposed drilling program, with options pending pollution and/or safety issues**

ACTION ITEM
Bob Bruce will act as watchdog.

Andy Fisher presented the safety review for Proposal 545 (Hydrogeology of the Juan de Fuca Ridge). This is a two leg program and the panel is being asked to approve sites for both legs at this meeting. The program was designed to assess the fundamental nature of fluid pathways in the crust and the dynamic influences of hydrothermal fluid circulation. Specific experiments will identify the distribution of hydrologic properties in the basaltic crust; the extent to which crustal compartments are connected or isolated (laterally and vertically); linkages between ridge-flank circulation, alteration, and geomicrobial processes; and quantitative relations between seismic and hydrologic properties. The proposed experiments will be the first attempt to address the scaling issue of fluid flow. The program builds on previously drilled sites and will include both single well and cross-well experiments. The highest temperatures anticipated are at DR-1 and Dr-2 where temperatures may reach 140°C. Prior drilling in the region revealed little gas within the sedimentary section, principally as a result of the low organic carbon contents (typically less than 1.0%). The observed seismic anomalies are not thought to represent seeping fluids but are believed to be a result of the combination of basement relief, differential sediment thickness, heating from below, and variations in sediment properties.

Site-by-Site Approvals for Proposal 545 (Hydrogeology of the Juan de Fuca Ridge)

Site ID	Latitude	Longitude	Status	Comments
1026B	47°45.759'N	127°45.552'W	Approved	Cork replacement
1027C	47°45.387'N	127°43.867'W	Approved	Cork replacement
SR-1	47°45.209'N	127°45.832'W	Approved to 860 m	Lat/Long represents a centerpoint for circle with a radius of 500 m
SR-2	47°45.662'N	127°45.674'W	Approved to 475 m	Lat/Long represents a centerpoint for circle with a radius of 500 m
FR-1A,C	47°54.105'N	128°33.468'W	Approved to 110 m	Lat/Long represents a centerpoint for circle with a radius of 500 m
FR-1B	47°54.132'N	128°33.591'W	Approved to 110 m	Lat/Long represents a centerpoint for circle with a radius of 500 m
DR-1	47°38.810'N	127°26.999'W	Approved to 660 m	Lat/Long represents a centerpoint for circle with a radius of 500 m
DR-2	47°37.449'N	127°20.049'W	Approved to 940 m	Lat/Long represents a centerpoint for circle with a radius of 500 m

Dave Goldberg and Shin'ichi Kuramoto (CDEX) presented an overview of LWD. This part of the meeting was held jointly with SCIMP. The focus was on the LWD activities associated with Leg 204. It was noted that there are three different approaches to LWD without real time monitoring:

1. the use of twinned wells – where a cored well is drilled first and then followed by an LWD hole. This LWD hole need not be drilled on the same leg as the cored hole.
2. the use of a reference whole – where a single reference core is first drilled, with the understanding that it will "sample" all of the necessary stratigraphic levels. This reference hole is then followed by a series of LWD holes. This was the approach to be used for Leg 204.
3. the initial drilling of an LWD core without any reference hole.

The follow-up discussion revealed that although the reference hole approach was to be used the selection of its location did not permit the characterization of a key reflector, which when later cored was found to contain significant amounts of gas. The second issue that the discussion revealed was the length of the tool is up to 30 meters so the actual measurements can be significantly removed from the drill bit. A third issue raised that even if the data were collected in "real-time" no guidelines for interpretation and/or action were in-place. Key questions raised were:

1. What are adequate and appropriate means of evaluating drill sites for safety issues in IODP? Same as in the DSDP/ODP programs? Are there different criteria for riserless versus risered drilling?
2. Can LWD/MWD sufficiently and adequately constrain safety concerns in place of coring and sampling?

    If YES - what protocol is required for data collection at each new drill site for safety evaluation? Should LWD/MWD always be recorded first, ahead of core data, if its available?

    If NO - what is the definition of "drilling blind?" (i.e., what is the acceptable delay time for core sample evaluation, or for LWD recorded data?)

ACTION ITEM
Dave Goldberg, all PPSP members, and operator representatives will begin the development of a series of guidelines for when and how LWD should be used in the program. Issues to be considered are the different platforms, different geologic settings, guidance for interpretation and action (specifically, under what conditions would the LWD data indicate that the hole should be terminated.

Meeting was recessed at 5:00 PM

Meeting was reconvened at 8:30 on Wednesday, December 17th at the Nagasaki Prince Hotel.

Koji Ochiai and Ryuta Kitamura presented an overview of JNOC's Nankai Trough Hydrate Drilling proposal. This was a requested courtesy safety review. The purposes of this study are to gather data to evaluate the resource potential of methane hydrates in the Nankai-Trough by gathering information on thickness, occurrence and distributions in the area between offshore Tokai and Kumano. In addition drilling will verify the relationship between seismic anomalies such as BSR and interval velocity anomalies and actual hydrate occurrences. Cores samples will also be collected as part of the resource assessment. The program will evaluate some drilling and completion technologies considered to be critical for the offshore production tests of methane hydrates in the future. Plans are to drill first using LWD and then follow-up with coring. There are no plans to drill a reference hole first. The wells will penetrate about 100 meters below the BSR. Safety monitoring will be performed using an ROV for observation at the mud-line. They will be prepared to pump kill mud at a high speed and if necessary a cement slurry. Specific comments on the program could not be provided because of the limited nature of the data presented. It was, however, noted that the approach to drilling and safety/hydrocarbon monitoring differed significantly from those utilized by the drilling program. As a result of these difference the Panel will invite the speakers back to further share the lessons learned so that they may be considered for IODP operations.

Jim Channell presented the safety review of Proposal 572 (North Atlantic Paleoclimate). This program will examine a series of goal undisturbed, Pliocene to Quaternary sections at locations that have shown (from existing conventional piston cores) to preserve both important climatic records and the lithologies suitable for paleointensity assisted chronology (PAC). PAC provides a means to address stratigraphic correlations on millennial time-scale. Paleomagnetic intensity varies significantly over periods of thousands of years and appears to be reflected the dipole field. These data are also correlatable with the ice core record. The selected area is both sensitive to climate change and has very high rates of sedimentation so that the millennial scale is captured. IODP cores will permit an examination of the long-term millennial record. The program will take 3 or more APC holes until refusal at each site, with requested penetrations of 400 meters. This program has been broken into two legs.

Site-by-Site Approvals for Proposal 572 North Atlantic Paleoclimate

Site ID	Latitude	Longitude	Status	Comments
IRM-2A	62°40.20'N	37°27.61'W	Approved to 400 m	Re-drill of 919 which was abandoned because of mechanical and weather problems
IRM-3A	62°20.11'N	36°12.30'W	Approved to 400 m	
LAB-3A	58°2.169'N	48°27.57'W	Approved to 400 m	
LAB-6A	57°28.5078'N	48°31.842'W	Approved to 400 m	
LAB-7A	58°14.2267'N	46°38.5888'W	Approved to 400 m	
LAB-8A	58°28.7540'N	46°27.3428'W	Deferred	Approval pending reprocessing
LAB-8B	58°33.2271'N	46°18.0404'W	Approved to 400 m	
ORPH-2A	50°12.40'N	45°41.22'W	Approved to 200 m	
ORPH-3A	50°9.984'N	45°38.273'W	Approved to 300 m	
GAR-1B	56°21.882'N	27°53.310'W	Approved to 400 m	New designation and location
GAR-2A	53°3.40'N	33°31.78'N	Approved to 400 m	
IRD-1A	49°52.667'N	24°14.287'W	Approved to 400 m	Re-drill of Site 609
IRD-3A	41°0.068'N	32°57.438'W	Approved to 311 m	Re-drill of Site 607 – Deeper penetration could be approved pending review by PPSP of the original safety package
IRD-4A	42°50.205'N	23°5.252'W	Approved to 400 m	Re-drill of Site 608

ACTION ITEMS

- **Proponents to reprocess seismic line KN166-25a in order to determine whether there are any gas indicators at proposed location LAB-8A**

- **Daniel Quoidbach will retrieve the safety package for Site 607 (IRD-3A)**
- **Daniel Quoidbach will present the datasets for LAB-8A and IRD-3A at the June PPSP Meeting**

Michael Riedel presented the safety review for Proposal 553 (Cascadia Gas Hydrates). The stated goal for this program is to constrain models for the formation of deep sea gas hydrate in subduction zone accretionary prisms. Specifically to:

1. Study the formation of natural gas hydrate in marine sediments
2. Determine the mechanism of development, nature, magnitude and distribution of gas hydrate reservoirs
3. Investigate gas transport mechanisms, and migration pathways through sedimentary structures, from site of origin to reservoir
4. Examine the effect of gas hydrate on the physical properties of the enclosing sediments
5. Investigate the microbiology and geochemistry associated with hydrate formation and dissociation
6. Long-term hydro-geological observations with ACORK and DTS

Testing these models and determining the appropriate model parameters requires:

1. an accurate definition of the vertical distribution of hydrate and gas,
2. accurate formation temperatures to define the base of the stability field,
3. physical and fluid chemical data, and downhole measurements that define the vertical advection rates of fluids and of methane,
4. calibration of the effect of hydrate and gas concentrations on velocity, resistivity, and other physical parameters for interpretation of both downhole data and seafloor measurements and surveys,
5. determination of the sediment pore pressure and permeability that drive the upward advection.

It is anticipated that the proposed output will provide the necessary data for testing the models. The proposal consists of a main margin-perpendicular transect of 6 Sites. They represent different stages in the accretionary prism development, and thus different stages in the formation of gas hydrates and related fluid flow. In addition to the transect, a location was selected near the Nootka Fault to determine what role, if any, earthquakes may play in the formation of gas hydrates. These newly acquired data will complement data from Sites 888, 889, and 890.

Concerns were expressed by the panel feeling that the presented data were inadequate to support a safe drilling project. The requested drill depths could not be supported by the seismic data.

Site-by-Site Approvals for Proposal 553 (Cascadia Gas Hydrates)

Site ID	Latitude	Longitude	Status	Comments
CAS-04B	48°33.461'N	127°9.934'W	Approved to	
CAS-03B	48°37.058'N	127°2.413'W	Deferred	Pending processing of multichannel data
CAS-03C			Deferred	Pending processing of multichannel data - New name designation
CAS-02B	48°38.579'N	126°59.227'W	Deferred	Pending processing of

				multichannel data
CAS-01B	48°41.884'N	126°51.924'W	Deferred	Review comparing with data from Sites 889/890
CAS-01C	48°40.682'N	126°50.630'N	Deferred	Review comparing with data from Sites 889/890
CAS-06A	48°40.050'N	126°51.053'W	Deferred	Pending processing of multichannel data – need to determine drilling "rules" for locations with vent communities
CAS-06B			Deferred	New name designation
CAS-05B	48°44.161'N	126°47.537'W	Deferred	Pending processing of multichannel data
CAS-07A	49°17.00'N	127°26.00'W	Deferred	Available data may be inadequate – would prefer multi-channel data – better 3.5 khz would be helpful as would backscatter data

ACTION ITEMS

- **Jack Baldauf to determine who would fund any supplemental data acquisition if required by PPSP for safety review but not previously required for scientific review.**
- **Jack Baldauf to check with the Canadian authorities if there are any environmental restrictions that might impact drilling in the cold seep location.**
- **Barry Katz will check if there are any IODP restrictions on drilling in the vicinity of seep communities.**
- **Proponent will need to determine if the proposed location CAS-05B is outside of the currently defined munitions dump site.**
- **Proponent will need to prepared displays that show the results and a data comparison for Sites 889/890 and proposed location CAS-01B and CAS-01C. A similar display needs to be made for Site 892 and proposed location CAS-06B.**
- **Proponent needs to redisplay data used to support CAS-06B at an expanded horizontal scale.**
- **As a result of poor imaging the panel has requested that the proponent complete the processing of the available multi-channel data prior to the review.**
- **Proponent will need to advise the Chair by April 15th whether the required actions can be completed in time for assembly and distribution of the safety packages for the June PPSP meeting**
- **Toshi Matsuoka will act as watchdog**

The panel reviewed the proposed gas monitoring plan drafted by Alister Skinner for mission specific platforms. It was noted that the MSP vessels will not have a permanent laboratory facility and will typically have limited space for both equipment and scientists/technicians consequently alternative means of hydrocarbon monitoring may be required. It was also agreed that monitoring guidelines need to be consistent across platforms, noting that there will be differences in the actions required among the platforms if hydrocarbons are encountered (i.e., riser vs. non-riser). It was suggested that although the proposed monitoring program may be acceptable the available information was too limited to recommend its adoption for the first MSP leg, particularly because of the environmentally sensitive nature of the Arctic. It was stated by George Claypool that the in-place system has proved satisfactory for many years and it would be unwise to replace it without the necessary supporting data. The panel agreed that it needed to review and potentially up-date the guidelines.

ACTION ITEMS

- **Colin Brett will provide to the panel the specifications of the instrumentations proposed by ESO for hydrocarbon monitoring.**
- **PPSP members and operator representative will outline experimental plans to test alternate gas monitoring systems using the *Joides Resolution*. These should be forwarded to Barry Katz by March 1st for compilation and subsequent forwarding to Jack Baldauf.**
- **All PPSP members and operator representative will review current guidelines and be prepared at the June meeting to initiate discussions on possible revisions. Current guidelines and suggestions provided by Alister Skinner are attached for reference as is a document prepared by C. Broglia, Lamont/BRG for gas detection by logging.**

The chair presented the draft of the IODP Environmental Policy Statement (attached). It was explained that this will represent the common umbrella for the three operators. The operators will prepare a similar document for health and safety.

ACTION ITEM

- **All PPSP Members are asked to review and provide comments to Barry Katz by January 15th for compilation.**

Additional panel business was discussed.

> At the request of Daniel Quoidbach the panel members were again asked if there is a need for paper copies of the safety package. The majority of the members requested that the paper copies still be provided. It was agreed that both paper and electronic versions will continue to be supplied to all panel members.

Pending all necessary approvals PPSP has scheduled the December meeting for the 6th and 7th in Hawaii. Venue to be determined.

Reminders that their will be e-reviews for Proposal 512 (Oceanic core complex) and Proposal 543 (CORK in Hole 642E).

Added to the June meeting agenda will be "final" reviews of the Gulf of Mexico and Cascadia pending the completion of the tasks outlined by PPSP and the initiation/continuation of discussions on guidelines for both LWD and safety/hydrocarbon monitoring.

ACTION ITEM

- **Dan Quoidbach will provide the safety packages to PPSP members for the e-reviews of Proposal 512 and 543 by May 1st.**
- **Proponents presenting at the June meeting will need to provide Dan Quidbach with completed safety packages by May 25th for duplication and distribution. The e-review safety package deadline will be April 1st.**
- **Barry Katz will advise the proponents of the deadlines and meeting date and location.**

The panel thanked Nobuo Morita, Toro Nishikawa and Mariko Tanaka for their logistical support of the meeting.

Meeting was adjourned at 3:15 PM

IODP Environmental principles

As a community exploring the pristine ocean environment, we recognize that we all carry a responsibility to ensure that our activities have a negligible impact. We therefore are determined to conform to the highest levels of environmental sensitivity: All members of the IODP ocean science community will familiarise themselves with the principles tabulated below and, as and when relevant, will ensure that they are adhered to by both themselves and others. These principles will enhance awareness of environmental issues in members of the community and, as such, will constitute a basis for IODP's expectations of scientific staff, particularly those participating in drilling operations. They define the standards that IODP operational organizations and contractors are committed to adhere to fully.

The implementing organizations (JA, CDEX and ESO) and their operational contractors are fully responsible and accountable for drilling and related activities to their funding organizations, the NSF, MEXT and ECORD, as well as to the international public.

Protection of marine life and the environment

- IODP will minimize the release of any substances into the marine environment that could cause damage to marine organisms.
- When operating, IODP seismic data will be collected according to the latest guidelines for seismic operations to minimize impact on marine mammals.
- IODP will minimise the drilling footprint in environmentally sensitive areas.
- The operators will obtain all necessary permits.
- A review of risk will be conducted by IODP's Pollution Prevention and Safety Panel and by the contracted operators for all drilling operations.
- IODP will act to minimize any and all risks identified through appropriate control measures.

Disposal of waste materials and restitution of the environment

- When operating within national jurisdictions IODP will follow their requirements for the handling of drilling by-products.
- Only non-hazardous material will be returned to the sea floor.
- IODP will assess the amount of material released to the sea floor.
- All other materials will be disposed of in accordance with international standards.

Storage and curation of potentially harmful substances/organisms

- Samples will be transported and stored in such a way as to prevent contamination of the environment.

Keeping the public informed of our activities

- We will inform the public of our operational plans.

Mission Specific Platforms.

Discussion document for PPSP and others

Safety Issue – prevention of Gas Blowout/Hole Instability while Coring

Introduction

Two general procedures were relied upon to prevent, or seriously reduce the likelihood of, ODP from meeting a hazardous situation while drilling sediments that might contain hydrocarbon accumulations. The first was the site selection and review process, in which proposed drill sites with geological factors conducive to hydrocarbon accumulations were either eliminated from the drilling programme or relocated to avoid possible safety problems. The second was regular monitoring of cores to ensure that sediments being drilled, did not contain greater than expected amounts of hydrocarbons. Shipboard personnel were faced with the practical problem of distinguishing. " Expected" or "Normal" amounts of hydrocarbons, from "Greater than expected" levels of hydrocarbon occurrence that could be cause for cessation of drilling.

It is not possible to specify quantitatively amounts or proportions of hydrocarbons that would be cause for site abandonment, under all conditions. Relatively small amounts of wet gas hydrocarbons could be cause for concern when coring in young, cold sediments overlying an older, possibly oil-generating sedimentary section. In contrast, evidence of slow in situ hydrocarbon generation should be expected when coring in organic matter-rich sediments at elevated temperatures.

The following is extracted from the ODP PPSP guidelines and is very relevant to MSP operations:

It should be kept in mind that the quantity of gas present in the sediments being drilled is as important as the source of the gas. In the absence of a functioning pressure core sampler, there is no method for accurately estimating the quantity of gas associated with a given quantity of sediments. A quantitative scale for rating the amount of gas in core, called gas quantity factor (GQF), was developed by Glenn Foss (supervisor, drilling operations, ODP-TAMU). The GQF scale is useful as a guide, based on past observations:

GQF 0 - No noticeable degassing or detectable hydrocarbons in core tube samples.

GQF 1 - Detectable hydrocarbon gas, but insufficient for reliable analysis. No notable pressure, separations or bubbling.

GQF 2 - Sufficient hydrocarbon gas for analysis of core tube samples. Widely scattered bubbling and/or separations.

GQF 3 – "Frying" or "Chirping" sounds of gas bleeding from indurated cores. Slight bulging of end in storage rack. Minor checking (i.e. incipient cracking) and cracking in softer cores.

GQF 4 - Pronounced bubbling of gas from core on retrieval. Numerous small separations in soft cores. Strong bulging of end caps.

GQF 5 -Numerous large separations in soft cores. End caps blown off. Small amounts of soft core extruded from sections on rack.

GQF 6 - Indications of pressure before opening core barrel -water forced out through check valve at top of barrel. Pronounced expansion of soft core on removal from barrel.

GQF 7 - Core catcher forcibly blown off. Very large gas-filled voids in core liners.
These GQF guidelines do not necessarily indicate safe operational limits. However, GQF can be used to estimate trends of relative gas content with depth. The last two stages. GQF 6 and 7 may indicate presence of gas hydrates in cores.

MSP Coring and Gas Hazards
In most instances Mission Specific Platforms are is likely to be operating in water depths of less that 1500m and will have much less drilling capability than a full oilfield 'spread'. This includes the mud pump capacity, the derrick pull-out capacity and the drillstring torque capacity. This means that all MSP operations have to be conducted with an even greater margin of safety when it comes to the evaluation of gas in sediment/hole and hole stability issues. In general a biodegradeable polymer mud will always be used or available to assist with hole stability and the possibility of encountering gas in sediment will be paramount in all drilling procedures.

For Mission Specific Platforms the site selection remains the main safety procedure and in areas where gas accumulations can be identified from high resolution seismic records or where previous drilling shows that gas shows have been encountered – *drilling will not be attempted.*

For Mission Specific Platforms the second safety procedure of regularly monitoring the cores will be expanded.

1. After each core run, and prior to tripping out the core-barrel (irrespective of what coring method is being used), the driller will observe his mud pump and standpipe pressures and ensure that they are 'normal' for the circumstances (heave and depth of borehole). If all is in order he will then commence the core barrel retrieval process. If all is not in order he will prepare for the borehole 'Kill' procedure and maintain circulation at this stage.
2. When the core is on deck it will be visually inspected (as in ODP) for any signs of gas but it will also be routinely 'sniffed' at the core end(s) in order to detect the presence of any gas (e.g. H_2S, CH_4, CO_2, CH_2). Sensitivity of this equipment is variable and dependent on the type of gas being measured but is compatible with safety both in realizing gas is present and in allowing dialogue on whether to continue. BGS have not yet chosen a system to do this because the whole procedure will have to pass muster with PPSP.

The determination that gas is present, from either of 1 or 2 above will immediately set in motion the Gas Alert Procedure which is as follows: (This will also have to be dovetailed into the specific contractor's H&S and risk assessment documents).

1. Advise drilling superintendent that driller or core deck has detected gas in core. If at all possible advise at this stage as to the toxicity of the gas encountered. If H_2S is detected all drilling personnel are to be informed immediately and separate precautions taken. Continue drilling operations only to the extent that the drillstring is coupled and circulation is available to allow gas control by mud circulation if necessary. **Do not at this stage continue coring operations but continue to monitor the circulation pump pressures and have the 'kill mud' on immediate standby**.

2. Determine more information on the gas – composition and any idea of quantity. Relate this to core collected. Is it an organic-rich core either by way of biogenic material in sediment or source rock maturation? Is it a porous core or clayey/indurated?

3. Check core in liners which will have been capped and relate gas in core evidence to GQF scales and descriptions prepared for ODP. Be aware of the dangers of H2S in confined spaces.

4. On the basis of 2 and 3 determine whether it is a sedimentary or other (?structural feature or possibly both) which is allowing the development of gas accumulation in cores. If the level of H2S is unacceptable then stop coring operations and in any event remove the collected cores to an open space until they degassify.

    a) If there are hydrocarbons present, the sediment has pore spaces and there is an element of structural control over the strata which would allow gas accumulation then drilling should be stopped with no further penetration.
    b) If there are hydrocarbons present but no geological trap structure present, the sediment is organic-rich and the cores are not degassing profusely then the driller should be consulted regarding back pressures in the borehole. If all appears to be 'normal' then coring should proceed with caution and constant monitoring.
    c) If the next core run gives the same or greater GFQ as the first with gas encountered and any abnormal back pressures are encountered during or after drilling then **terminate the borehole**
    d) If the next core run follows a similar pattern to the first with gas encountered then make another assessement as above.
    e) If a third core run encounters similar conditions then **terminate the borehole**

Determination of Gas Composition

The most common method of hydrocarbon monitoring, used in ODP operations has been analysis of gas samples obtained from gas expansion pockets, visible through clear plastic core liners. Hydrocarbon monitoring techniques are designed to recognise small quantities of migrated hydrocarbons and appear to be used as a scientific geochemical tool as well as determining continuation or termination of a borehole.

Gas composition is commonly expressed as C1/C2 ratio, and plotted versus depth below sea floor. Previously, a PPSP recommendation of a C1/C2 ratio of about 1000 was used as a working guideline for termination of drilling during earlier phases of the DSDP. In ODP, are more close monitoring of the C1/C2 ratio, plus subsequent carbon isotope characterisation of methane allowed more complex relationships to be generated. "Normal" and "Anomalous" C1/C2 ratio was then defined in a geological context and was then used to determine whether drilling should continue or be stopped.

For MSP operations we will wish to establish immediately if gas is present and make a composition evaluation regarding H2S, CH4, CH2, CO2, probably in that order of hazard evaluation. We can also make an estimation of C1/C2 ratio but this may be academic for the purposes of safety regarding drilling operations. **In order to extract maximum science from**

any gas encountered in MSP operations separate samples should be collected for later evaluation of their geochemisty. This can be done according to well-established oil-industry procedures for geochemical exploration and involve the collection and freezing of subsamples in foil packs for later onshore laboratory analyses.

Gas Detection Options

Equipment for MSP operations will have to be portable, able to be calibrated on site and detect the presence of gas within as short a timespan as possible of the cores arriving on deck.

While portable GC equipment is available it is more sophisticated than is necessary to detect the presence of gas and may not be necessary to capture the science either if acceptable oilfield practices can be utilized for collection of subsamples for later hydrocarbon analysis.

A preferred option would be to go for multi-element gas detectors which can discriminate between the gasses chosen to detect and give quantative values of each subject to calibration. They will be measuring in ppm, or even in percent depending on the gas but are routinely used for gas detection in soil leachate, tunnels, trial pits and the like where human life is at stake.

My own opinion is that if we start to see gas in the cores then we are well above the detectable stage for any proposed evaluation equipment and a speedy analysis aiding controlled decisions is the most important issue. Indeed by that stage it may only confirm why we had stopped.

The way forward?

Given that MSP's will not have the equipment power ranges in pumps, drawworks and topdrive available on oilfield-type drilling units a much more cautious approach to drilling hazards has to be adopted in all cases and polymer mud will always be available to condition the borehole if not for use in drilling at all times. This will take care of many of the 'normal' drilling hazards associated with 'open hole' or uncased drilling without a riser or conductor.

With regard to gas hazards MSP operations require to be extremely prudent. I suggest that the well-established site selection procedures of ODP must be imported into IODP, followed and augmented by detail which may be suggested by the PPSP, co-chiefs or operator. An example is the New Jersey Margin where the sites appear to be 'safe' to drill but the PPSP evaluation requested a reprocessing of relevant geophysical data in accordance with gas hazard evaluation procedures for site survey/geotechnical operations. This report will be evaluated by the operator and co-chiefs, with reference to PPSP as necessary, before operations on that project can be commenced or the sites rejected on their unsuitability as determined by the additional work.

Once the go-ahead is given and drilling commences then the sensitivity of the smaller rig operations both allows close monitoring of pump pressures and hole torques. Close attention to the drilling parameters, together with constant monitoring of core lengths for gas content will allow a second stage review in near real time to determine whether to proceed or not.

I welcome discussion on this document, the outcome being to be able to implement a workable set of safety procedures which will stand up to the IODP requirements and the projects in hand.

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ESO Operations Manager

Draft version 1 – 4/12/2003

GAS DETECTION SYSTEMS

Technology

Logging While Drilling (LWD) technology provides speedier detection of gas thanks to the location of the porosity and density sensors near the bit and real-time transfer of the data to the analyst. Traditional gas detection systems are slower because gas measurements are conducted on a physical core specimen. First, a core up to 10 meters long is collected; once retrieved, a sample is analyzed in a gas chromatograph. The LWD routine eliminates the need for core. This saves time and also ensures the data is available when core recovery is less than 100%.

The hardware utilized to conduct real-time gas detection includes instrumented drill collars and a data acquisition system located in a ship-based laboratory. Two collars leased from Anadrill are used to accomplish the screening, the ADN (Azimuthal Density Neutron, Fig. 1) tool and MWD (Measurement While Drilling) sub. The MWD collar is connected below the ADN collar to pulse the data to the surface at 3-6 Hz, which is adequate sample frequency to provide data at 6-12 inch vertical resolution. The ADN uses wireline retrievable, chemical neutron and gamma-ray sources and an array of detectors to capture an oriented 360-degree density image of the borehole and continuous porosity and density data. The principles of the porosity and density log are detailed below. As the drill bit advances through freshly cut sediment and rock the acquired data are transmitted in real-time to the surface via mud pulse telemetry for recording and visual inspection. Additional information on this equipment is available at the Borehole Research Group web page (www.ldeo.columbia.edu/BRG)

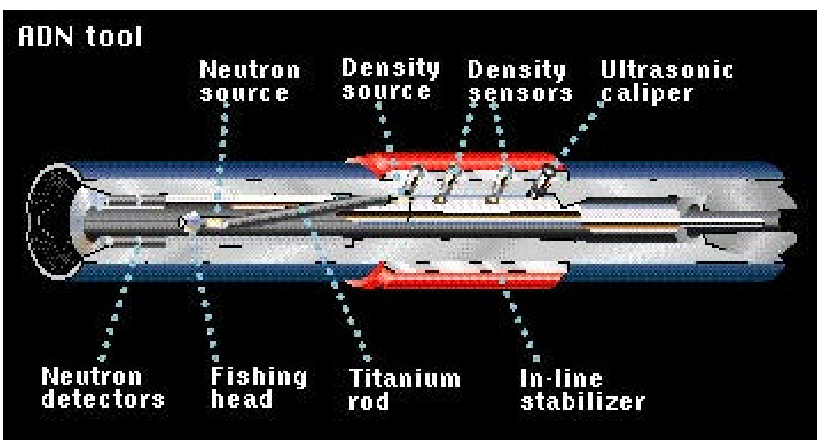

Figure 1. The ADN tool includes sources and detectors for the porosity and density measurements. This tool is connected in the drill string just above the MWD collar.

Porosity Logs

For years porosity logs, such as the density and neutron logs, have been effectively used in the oil industry to detect the presence of gas in the formation, as their response is notably different than in the presence of oil or water. Gas can be detected in the "invasion zone" near the borehole wall, in the form of residual gas that has not been displaced by the mud filtrate, or farther in the formation, in the "virgin" zone untouched by the drilling fluid. The former scenario is possibly more frequent in ODP boreholes, where sediment porosity is high (usually > 40%) and the seawater-based drilling fluid can easily penetrate the formation. In order to appreciate the full potential of this gas detection system it is important to understand the general physical principle of measurement of these tools. Some quantitative examples will help predict the effect of the presence of gas on logs recorded in real-time in ODP boreholes.

Neutron Log

The neutron log is the most important tool in gas detection. In fact, this tool responds primarily to the hydrogen in the formation. In neutron devices, fast neutrons are emitted by a nuclear source into the formation. Through collisions with the nuclei in the surrounding medium, they are slowed down until they reach a thermal-energy level at which they can be absorbed by the nuclei in the formation. The distance the neutrons must travel before they can be absorbed, called slowing-down length, is directly proportional to the hydrogen index of the formation, that is the quantity of hydrogen per unit volume. Hydrogen has a mass that is very close to that of a neutron and therefore it is the most efficient element in reducing the neutron energy.

Gas has considerably less hydrogen than water or oil: in a clay-free formation (clay having also an effect on the neutron log due to the presence of thermal absorbers) it shows on the neutron log as an abrupt decrease of the porosity reading, resulting in a value that is less than the true porosity of the formation (Figure 2). The density of the gas also plays a role: due to its lower hydrogen index, low-pressure dry gas is more promptly detected than high-pressure, wet gas. To the extreme end of the spectrum, gas hydrates show no typical signature on the neutron log, due to the high concentration of solid water molecules.

It can be demonstrated that in a clay-free, gas-bearing formation the neutron porosity reading is

$$\Phi_n = \Phi[\alpha S_{rh} + \beta(1-S_{rh})] \qquad \text{(Gaymard and Poupon, 1968)}$$

where

Φ_n = neutron porosity

Φ = true porosity

α = hydrocarbon hydrogen index (for gas, $<=0.55$)

β = drilling fluid hydrogen index = 1-0.4P

S_{rh} = saturation in residual hydrocarbons

P= NaCl concentration in ppm/10^6

ρ_h = hydrocarbon density (for gas $<=0.25$g/cc)

Density Log

The density tool carries a radioactive source emitting high-energy gamma rays into the formation. These gradually lose energy through collisions (Compton scattering) with the surrounding electrons, in a process that depends on the electronic density of the formation. For a given element or substance, the electronic density differs from the true density by a constant value that depends on its atomic number and weight.

In a clay-free, water-bearing formation the equation relating electronic density and reading of the density log is

$$\rho_b = 1.074\ \rho_e - 0.1883$$

while the general formula relating bulk density to porosity is:

$$\rho_b = \Phi\rho_{mf} + (1\text{-}\Phi)\ \rho_{ma}$$

Gas shows as an abrupt decrease in the density reading (Figure 2) because the electronic density of gas is smaller than that of water. It can be demonstrated that if we take into account the electronic density of gas, matrix, and mud filtrate in a clay-free, gas-bearing formation, the density reading becomes

$$\rho_b = \Phi\ \rho_{mf} - 1.07\Phi\ S_{rh}\ [(1.11\text{–}0.15P\ )\rho_{mf} - 1.15\rho_h] + (1\text{-}\Phi)\ \rho_{\ ma}$$

(Gaymard and Poupon, 1968)

where

ρ_b = density

ρ_{ma} = grain density

ρ_{mf} = mud filtrate density

General Formulae to estimate effect of residual hydrocarbons on neutron and density logs

The following equations allow for the calculation of the effect of residual gas on the neutron and density logs (Gaymard and Poupon, 1968):

Neutron log $\Phi_n = \Phi - \Delta\Phi_n$

$\Delta\Phi_n = \Phi\ S_{rh}\ [(2.2\rho_h - 1+0.4P)/(1\text{-}0.4P)$

Density Log $\rho_b = \rho\text{-}\ \Delta\rho_b$

$\Delta\rho_b = \text{-}1.0\Phi\ S_{rh}\ (1.11+0.65P\text{-}1.24\rho_h)$

Table 1 quantifies the effect of residual hydrocarbons on the density and neutron logs for porosity ranging from 40 to 60 %, salinity of the mud filtrate of 35,000 ppm, and ρ_h =0.2 g/cm^3 .

	F =40%	r b=2.02	F =50%	r b=1.85	F =60%	r b=1.68
SRH	DF	Dr b	DF	Dr b	DF	Dr b
10	-2.3	-0.03	-2.9	-0.05	-3.5	-0.06
20	-4.7	-0.07	-5.9	-0.09	-7.9	-0.11
30	-7	-0.11	-8.8	-0.14	-12.4	-0.17
40	-9.5	-0.15	-11.8	-0.18	-16.5	-0.23
50	-11.8	-0.19	-14.7	-0.23	-17.7	-0.28
60	-14.1	-0.23	-17.7	-0.28	-21.3	-0.34

70	-16.5	-0.27	-20.6	-0.33	-24.8	-0.4
80	-18.8	-0.31	-23.6	-0.38	-28.3	-0.45
90	-21.3	-0.34	-26.6	-0.43	-31.9	-0.51
100	-23.6	-0.38	-29.5	-0.47	-35.4	-0.57

Failure to detect gas presence: extreme invasion and presence of clay

There is a case where the neutron-density combination would fail to detect the presence of gas; it happens in a situation of extreme invasion, where the drilling fluid completely replaces the gas in the formation, to a depth that goes beyond the depth of investigation of these tools. In this case, close attention must be paid to the resistivity log; as gas is a non-conductor, it would be shown as a sharp increase of the resistivity reading.
Also, the gas-effect on the neutron log is attenuated by the presence of clay in the formation; in clay intervals, the high content of hydroxyls and possibly of other thermal absorbers, result in neutron readings that are higher than the true porosity and density readings that are higher.

Recommended data presentation

In order to highlight the possible presence of gas in the formation, the following scales are commonly used in the oil industry:
Neutron: 45 (left), -15 (right). Density: 1.95 (left), 2.95 (right)
Note that since the neutron porosity tool used in the ODP is calibrated to give limestone porosity units (decimal or %) the matrix density of limestone (2.71 g/cm^3) must coincide with zero porosity and each track division must correspond to 6 porosity units and 10 g/cm^3.
In ODP holes, where porosity and density values are usually >30% and less than 2.2 g/cm^3, an alternate scale can be chosen, which still takes into account the constraints mentioned above.

Example:
Neutron: 81 (left), 21 (right). Density: 1.35 (left), 2.35 (right)

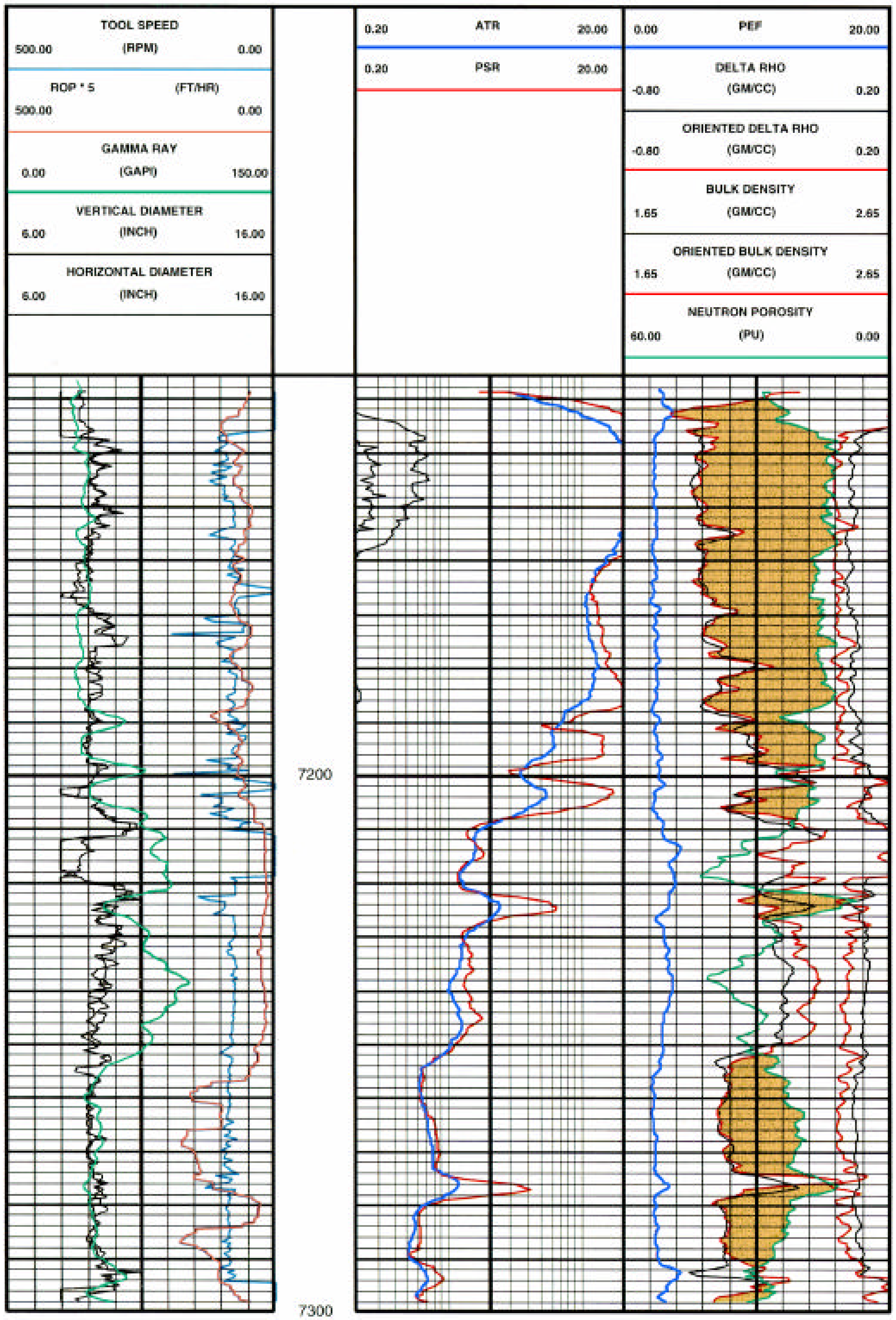

Figure 2. The shaded yellow area identifies gas-bearing intervals in the section logged. Note the crossover of the density and neutron logs opposite these intervals. Also note the resistivity increase and gamma ray decrease.

References

Gaymard R. and Poupon, A., 1968. Response of neutron and formation density logs in hydrocarbon bearing formations. The Log Analyst, Sep.-Oct., pp. 3-12.