VELOCITY ANISOTROPY OF UPPER MANTLE[1]

During the summer of 1966 a joint marine refraction survey was conducted across the Hawaiian arch by the Scripps Institution of Oceanography, the University of Hawaii, Oregon State University, and the University of Wisconsin. Conventional and unique types of refraction profiles were shot to study the directional dependence of velocity or velocity anisotropy of the mantle and the depth configuration of the Mohorovičić discontinuity. A two-dimensional delay time function method was used to study (1) the anisotropy and (2) the delay-time surface. The upper mantle was found to display compressional velocity anisotropy amounting to about 0.6 km/sec difference between the maximum and minimum velocities with the direction of maximum velocity being east-west. The delay time surface suggests that, as expected from earlier work, the mantle is generally shallow along the crest of the arch. The shallowest region occurs near the southeast end of the arch, where it intersects the Molokai fracture zone. The mantle deepens southwest of the crest of the arch as the Hawaiian deep is approached.

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OIL FIELDS, GRAVITY ANOMALIES, AND SURFACE CHEMICAL MANIFESTATIONS—CORRELATIONS, CAUSES, AND EXPLORATION SIGNIFICANCE

(No abstract submitted)

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GRAVITY OF NORTHERN CHANNEL ISLANDS

The northern Channel Islands form a regional gravity high which forms a break in the dominant northwest-southeast gravity pattern south of the islands and the east-west gravity and structural pattern found on the north in the Transverse Ranges province of California. Both northwest-southeast and east-west components are apparent in the gravity and structure on the islands. Thus, the northern Channel Islands lie on the border between Transverse Ranges structure and the northwest-trending structures characteristic of the rest of California.

The complete Bouguer anomaly values across the northern Channel Islands range from 20 to 80 mgal. North of the Santa Cruz Island fault there is little variation in the complete Bouguer anomaly except toward the east across the Anacapa Passage, where the complete Bouguer anomaly decreases sharply. This decrease reflects the deepening of the basement rock under the Santa Barbara Channel.

South of the Santa Cruz Island fault, a continuous gravity pattern extends from the schist exposures on Santa Cruz Island to Point Bennett on San Miguel Island. This continuity in gravity suggests that the basement rock and the Santa Rosa basin also are continuous from the southwestern part of Santa Cruz Island to the western tip of San Miguel Island. The lowest gravity values are found in the Santa Cruz Passage, a fact that indicates that the center of the Santa Rosa basin is between Santa Cruz and Santa Rosa Islands. This gravity low is an extension of the gravity low in the Santa Cruz basin on the south and suggests that the Santa Rosa basin is a northern continuation of the Santa Cruz basin. A gravity high south of San Miguel Island and a high north of Santa Rosa Island give evidence for two possible preexisting source areas, which supplied sediments to the area of San Miguel and Santa Rosa Islands.

Sparker profiles in the Santa Cruz Passage show the presence of a northwest-trending fault along Santa Cruz Canyon, but the continuity of the gravity data across this region shows that this fault is unimportant. A second fault, the Santa Rosa Island fault, cannot be seen on the sparker profiles, nor is it reflected in the complete Bouguer anomaly values over Santa Rosa Island. Therefore, this fault also is insignificant in regional structure. The Santa Cruz Island fault, in contrast, is reflected markedly in the gravity pattern over the island, and may have produced a large amount of lateral offset.

[1] Contribution of the Scripps Institution of Oceanography, new series.

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BOUGUER REDUCTION TECHNIQUE FOR SURFACE SHIP GRAVITY METER DATA

(No abstract submitted)

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APPLICATIONS OF CONTINUOUS REFLECTION PARAMETER DETERMINATION

This processing technique automatically extracts reflection information continuously in space and time from the CDP input data. The reflection parameters are obtained by a systematic search in time and moveout which yield an estimate of arrival time $T_i(X)$, amplitude $A_i(X)$, and moveout $\Delta T_i(X)$ for each depth point. The combination of all the reflector segments for the line forms a reflector segment file consisting of *all* coherent events reflected from the subsurface including primaries, multiples, diffractions, and "false alarms."

Variations in band width and the picking aperture of both time and moveout are investigated in this paper. Land and marine field data are used to illustrate the results.

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SEISMIC RECORD SECTION IN DEPTH

Automatic velocity-determination methods developed in recent years make it possible for the geophysicist to convert seismic information from time coordinates to depth coordinates. In making this conversion it is feasible to account for almost any horizontal velocity gradient and, under favorable conditions, to migrate the data and still have the results in the form of a record section. Although these procedures offer possibilities for saving labor and for improving interpretational insight, they should be used with the understanding that interpretation is involved and the results should be reviewed as new data are added.

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SEARCHING FOR STRATIGRAPHIC TRAPS

The main difference between a great anticlinal or fault trap and a great *other* kind is that the former is easy to find and the latter difficult. Thus, it is not likely that large traps of the anticlinal or fault types have been missed in well-drilled areas. But there is a fair chance that some great "other" kinds are still to be found.

Several techniques have been available for a long time, but none is routine. Detailed gravity-meter and torsion-balance surveys come high on my list, providing that core density values are carefully and competently measured (and now checked with a borehole gravimeter). Another important tool is the reflection seismograph, without CDP(!)—for scattered events, usually very poor.

These are only beginnings. They are of little value unless management, and searching engineers and scientists, are together in the gamble that focuses on the "big sleeper." They must look backward as well as forward. If they have made errors, they must study them to improve future practice. If they have been lucky, they must find why, to improve future practice—or continue to rest on luck.

So, try to get *good* case histories (not only the parts that justified pride but also the errors). Look for observations that were not thought necessary (*luck* was too good to require them!) but might still be made. Try to decide how that giant (*e.g.*, East Texas) might have been found with a *minimum* of good luck. This requires a very careful analysis and understanding.

Recognize the simple fact that no technique can ever be regarded as *sufficient* for success in this venture. No routine package can be sold with a claim that if you manage your field teams and fine instruments according to directions you can have success.

However, there are certain *necessary* conditions—the kind of conditions you can look back on. Possibly the most important of these is "a high level of intellectual honesty, general competence, and a wish to know fact from fiction for the purpose of future productive use through the whole exploration and production group." Though the industry does seek new ideas and processes quite actively, it is not particularly noted for relinquishing mistaken ideas—especially when these ideas have been very expensive. Thus a kind of smokescreen is erected by many circumstances. The air needs to be cleared by critical reexamination of premises.

It is interesting and valuable to inquire "what measurable differences exist in an environment of a large petroleum accumulation that are due to this accumulation?" The effects may be a little subtle, but not completely absent.

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Title to be announced

(No abstract submitted)

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PORTABLE REFRACTION SEISMOGRAPHY SURVEY OF GOLD PLACER AREAS NEAR NOME, ALASKA[1]

A seismic refraction study of the beach and tundra gold placer areas near Nome, Alaska, was made using a small, light-weight, portable seismograph during the summer of 1967. Geophone configuration and type of energy source were determined during a preliminary experimental survey.

Because the beach study was successful, a short experimental seismic line was completed inland to determine the usefulness of a portable refraction seismograph in permafrost areas near Nome. Basic problems in permafrost areas are the high seismic velocities in the overburden, caused by increase in elastic modulus in frozen ground, and the acoustical absorption and variable thickness of the overlying tundra. The increase in sediment velocity reduces the possibility that there is a marked velocity contrast at the bedrock-overburden interface, and the organic material of the tundra absorbs returning seismic energy. These problems were reduced by detonating the explosive energy source on the permafrost surface and by placing the geophones in the thaw zone of silt beneath the spongelike matter of the tundra.

The beach survey results indicated that internal stratigraphy of the overburden could be interpreted and seismic velocities assigned to the different units. A very low-velocity, dry to damp layer of Holocene sands covering most of the beach has seismic velocity values of 0.15–0.73 km/sec. In other low-velocity layers included in the overburden, and especially conspicuous near river mouths, velocity values range from 0.62 to 1.00 km/sec. A poorly consolidated nearshore or estuarine silt, clay, and sand layer of Sangamon age (late Pleistocene) with velocity values of 1.20–1.80 km/sec is below the very low-velocity layer. Beneath the estuarine material is a till of Illinoisan age (middle Pleistocene) that has a velocity of 2.80–4.00 km/sec. Bedrock was well defined in all seismograms and exhibited velocity values from 4.20 to 5.60 km/sec.

A basement contour map of the beach was constructed from depth data obtained along the beach with the refraction seismograph, from offshore seismic-reflection data, and from onshore drillhole information. Several buried channels were identified which may be sites of possible gold placer deposits. Beneath the tundra a bedrock surface dips under Dry Creek from both sides, and a bedrock contour map was drawn from refraction-seismograph data and drillhole information. Results of the Nome tundra survey illustrate the feasibility of the portable seismograph as a placer prospecting tool for use in tundra-permafrost areas.

[1] Publication authorized by the Director, U.S. Geological Survey, Washington, D.C.

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Title to be announced

(No abstract submitted)

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STRUCTURE OF THE CONTINENTAL SHELF OFF SOUTHERN OREGON

A detailed continuous seismic-profiling survey was conducted on the continental shelf off southern Oregon between Cape Blanco and the Oregon-California border during the summers of 1967 and 1968. This part of the shelf is divided into northern and southern regions, which appear to be unrelated structurally. The surface trace of a prominent angular unconformity, which crosses the continental shelf in a WSW direction between Cape Sebastian and the Rogue River, is the dividing line between the two regions. A series of folds parallel or subparallel with the coastline characterizes