Regulatory Docket File

Seismic Reflection Data from the Offshore Region Between Point Estero and Point Arguello: Interpretive Data and Discussion

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Contents

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is juxtaposed to the east against Acoustic Unit A_3 type seismic returns, which are interpreted to represent an upraised block of basement Acoustic Unit A_3 and deformed Acoustic Unit A_2-equivalent rock. The boundary between the basal Acoustic Unit A_2 part of the offshore section and the inferred A_2-A_3 near-shore section is interpreted to represent an east-dipping reverse fault. The inference that this boundary represents a fault contact is based on the apparent abrupt large vertical separation across it, and on the interpretation that the prominent diffractions present on the unmigrated line W74-12 record are associated with a fault surface. The reverse fault contact is overlapped without break by the upper, Acoustic Unit A_1, part of the offshore basin section.

The part of the offshore Santa Maria Basin East Boundary zone that has been affected by post-Pliocene fault movements is referred to as the Hosgri fault or fault zone. The outer, main break along the post-Pliocene fault zone is indicated on the unmigrated line W74-12 record only by vague diffractions (since it is not well displayed in the acoustic frequency range used to produce the Western seismic lines), but it is clearly identifiable on most sparker seismic reflection lines. Likewise, the details of structural deformation adjacent to this fault are observable on sparker lines (e.g., Figures 9A, 12A, 13A, and 14A of Appendix A to Appendix 2.5D to the Diablo FSAR), but not on the Western Geophysical lines. Features appearing on the two versions of line W74-12 that are considered to be artifacts of the data recording and/or processing operations include two water-bottom multiples (on both unmigrated and migrated versions), diffractions from the Hosgri and the buried fault planes on the unmigrated record, and arcuate patterns of alignments referred to by Western Geophysical as "velocity diffraction patterns" on the migrated record. These latter features are important because they could, if confused with true bedding reflections, be the cause of a misleading interpretation of the geologic structure. The velocity diffraction patterns appear as partly overlapping concentric arcuate lines that are centered about point sources located at intervals of about 16,000 feet, ground distance. They are most prominent near the ends of lines, in areas of data dropout, and in zones where slight velocity errors occur in the migration process. These conditions mostly exist where Acoustic Unit A_3 and deformed Acoustic Unit A_2 parts of the section are represented in the record. In general, the velocity diffraction patterns have a much lower degree of coherency than reflections from bedded strata.

The apparent geologic significance of the information contained in the line W74-12 record is that evidence of a pre-upper-Pliocene episode of compressional deformation is indicated there. This episode of tectonism probably corresponds to the compressional deformation represented by the deep synclinal folding of the San Luis Range. The evidence from other, higher resolution records showing the upper several thousand feet of the present Hosgri fault zone indicates that its post-mid-Pliocene history has been characterized by extensional and probably also by lateral slip movements rather than the reverse movements shown at depth on line W74-12.

II

Note on Comparison of Fault Locations near the Diablo Canyon Site as Observed on Seismic Reflection Records from Different Surveys

Introduction

Records and post-plot track charts from four different seismic reflection surveys of the offshore area near the Diablo Canyon site are available. The track charts and records from three of these surveys (USGS Kelez, 1973; BBN, 1973-74; Aquatronics, 1974) have been submitted as part of the documentation of geologic interpretations for the Diablo Canyon FSAR. Records and track charts for a survey conducted by Western Geophysical Co., Inc. in 1974 have also been used for the interpretations presented, but the records themselves, being proprietary, have not been submitted directly.

Discussion

The offshore area near Diablo Canyon has been intensively surveyed by seismic reflection techniques. Within the reach extending about 12 miles from Point San Luis north to the southerly part of Estero Bay, some 55 separate lines have been surveyed and are available for interpretation, as shown on the track chart base to Plate II(N) and in Table A.

These lines were all run in 1973 and 1974. The USGS Kelez and Western records were from parts of regional coastal surveys, while the BBN and Aquatronics surveys were concerned specifically with the area offshore from Diablo Canyon. The Western, BBN, and Aquatronics surveys were all navigationally controlled and post-plotted by Navigation Services, Inc., using computer-reduced plots of continuous radio-transponder records of the survey ship's position. This system is said to be accurate to within a few feet when good station control is available, as it was in the Diablo area.

The original FSAR map of the position of faults in the Diablo offshore area was based on interpretation of records from the BBN, Aquatronics, and Kelez surveys. These records were all obtained using sparker type energy sources, which varied in resolution and penetration from the very high resolution .5 second penetration 3 Kj Aquatronics system to the intermediate resolution 1.5 second penetration 90 Kj Kelez system. The latter system achieved nearly 10,000 feet of penetration.

Interpretation of these data resulted in a map showing four main breaks within the Hosgri fault zone. Directly opposite from Diablo Canyon, these breaks ranged from about 2.7 to 4.7 miles distance offshore. The outermost break was seen only in the deeper part of the section, and was mapped as a buried fault.

The records obtained from Western Geophysical were of the computer-processed deep seismic type. These records register to 5.0 seconds penetration, but are of much lower resolution than the sparker records. Because of the nature of the recording and the computer processing, which are designed to maximize the return of information from the deeper part of the section, the Western records show no usable information in the uppermost 500 to 1000 feet of the section. Consequently, faults of small displacement in the near surface part of the section are in many cases difficult or impossible to detect in such records.

In the case of Western line W74-12, run nearly opposite Diablo Canyon, the chief feature that relates to faulting is a deeply buried steep reverse fault that corresponds to the outermost buried fault shown on Plate II(N). This fault truncates the easterly end of the deeper (Lower Pliocene-Miocene Acoustic Unit A_2) part of the offshore Santa Maria Basin section against Mesozoic basement and upraised Acoustic Unit A_2 rock, but is overlapped by the shallow Upper Pliocene Acoustic Unit A_1 section without break. Smaller breaks that extend to the surface at points closer to shore are only vaguely suggested in the Western records.

Line W74-12 was obtained both in standard format and also with computer migration processing, the latter in order to determine whether significant errors of subsurface geometry and position could be present in the unprocessed record. It was found that the migration caused little change in the apparent position of the buried fault, and that it resulted in appreciable degradation of the nearer surface part of the record.

It is considered significant that the major fault break seen on line W74-12 is a deeply buried feature, and that it corresponds to a similar feature mapped at the same location using the three sets of sparker records available previously. These higher resolution records clearly show an unbroken Pliocene section several hundred feet thick extending across this fault.

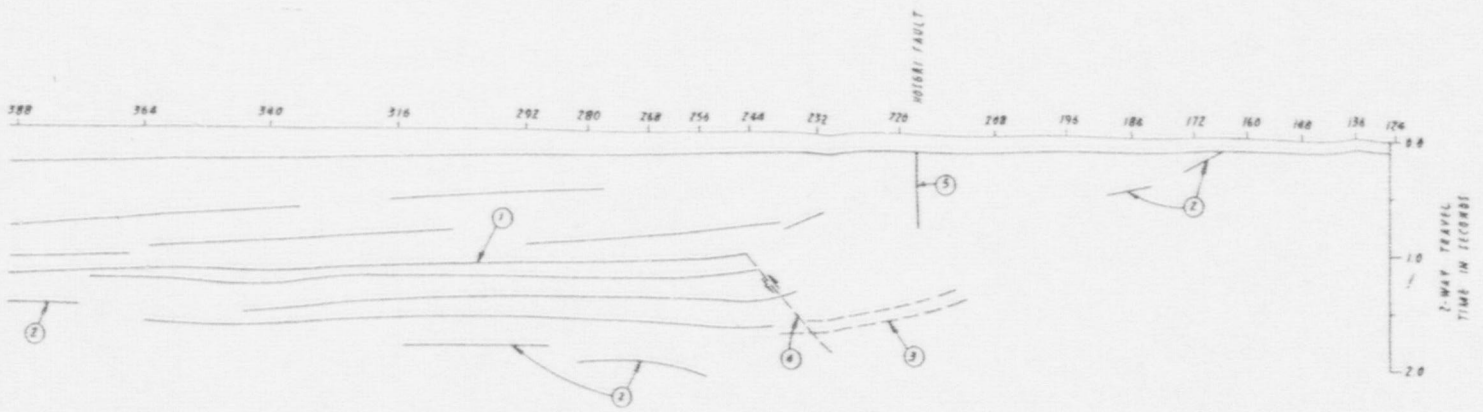
Table A

Seismic Reflection Lines Surveyed

in the Offshore Area Between Estero Bay and Point San Luis

Kelez	BBN	Aquatronics	Western
		50	
123		SS-1	W74-14
	27	SS-2	
		SS-3	
125		48	
	25-26		
		46	
127			
	23	PB-1	W74-80
129	21		
	19	44	
	17	PB-2	
131	15	42	
	13		
		PB-3	
133	11		W74-12
		38	
		PB-4	
135	9		
	2		
137	4		
	6	36	
	8		
	10		
139	12		
	14		
	16		
	18		
	20	34	
141			W74-82
	22		
		32	
		30	

Kelez	BBN	Aquatronics	Western
143			
	7		
145			
147			
	5		
149			W74-10



NOTES

1. REFLECTOR INTERPRETED TO REPRESENT THE UNCONFORMITY BETWEEN UPPER MIOCENE-LOWER PLIOCENE (ACOUSTIC UNIT A_2), AND UPPER PLIOCENE (ACOUSTIC UNIT A_1) STRATA
2. REFLECTORS INTERPRETED TO REPRESENT THE UNCONFORMITY BETWEEN UPPER MIOCENE AND OLDER OR MORE DEFORMED (ACOUSTIC UNIT A_3) ROCKS.
3. ALIGNMENTS INTERPRETED TO BE AMONG THE "VELOCITY DIFFRACTION PATTERNS" ON LINE W74-12
4. INTERPRETED POSITION OF BURIED REVERSE FAULT
5. POSITION OF MAIN TRACE OF THE NOIGRI FAULT

APPROXIMATE SCALE

0 1 2 MILES

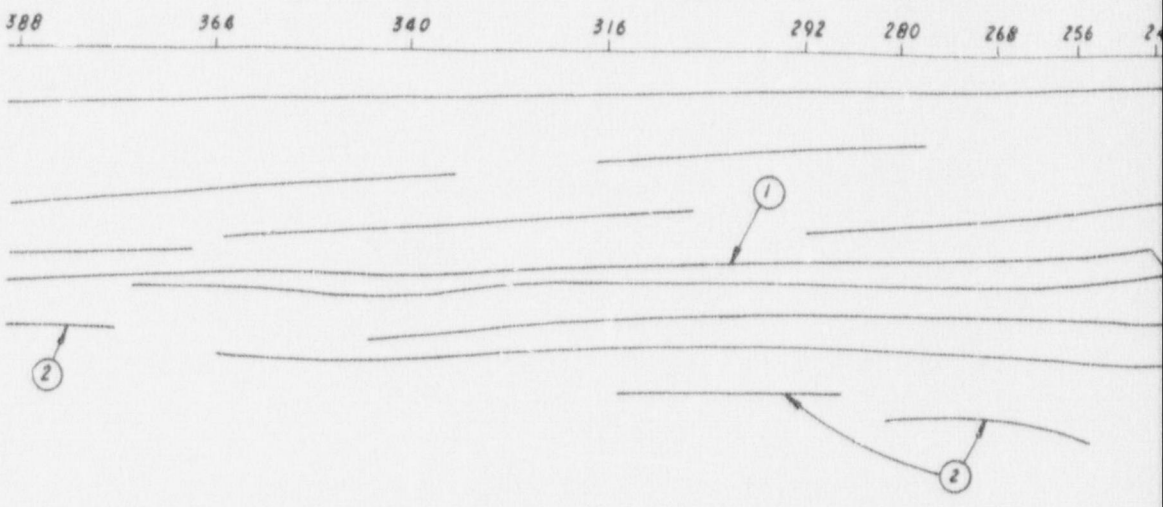
0 2000 4000 6000 8000 10 000 FEET

HORIZONTAL = VERTICAL

PLOT OF REFLECTORS AND OTHER FEATURES ON WESTERN GEOPHYSICAL COMPANY LINE W74-12 (MIGRATED)

FIGURE 1

FSA 1318



NOTES:

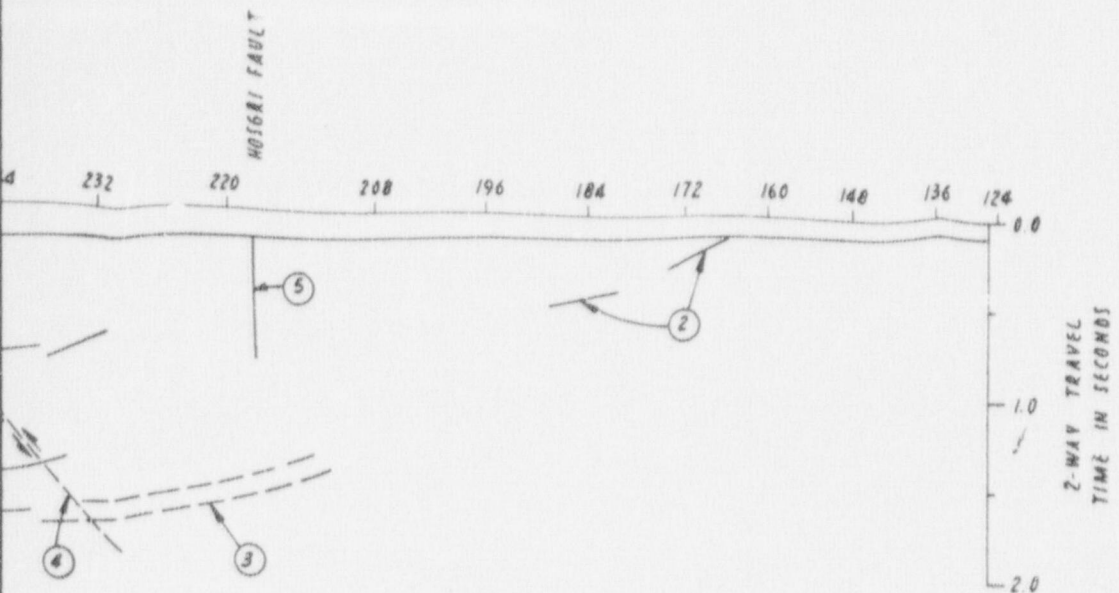
(1) REFLECTOR INTERPRETED TO REPRESENT THE UNCONFORMITY BETWEEN UPPER MIOCENE-LOWER PLIOCENE (ACOUSTIC UNIT A_2), AND UPPER PLIOCENE (ACOUSTIC UNIT A_1) STRATA.

(2) REFLECTORS INTERPRETED TO REPRESENT THE UNCONFORMITY BETWEEN UPPER MIOCENE AND OLDER OR MORE DEFORMED (ACOUSTIC UNIT A_3) ROCKS.

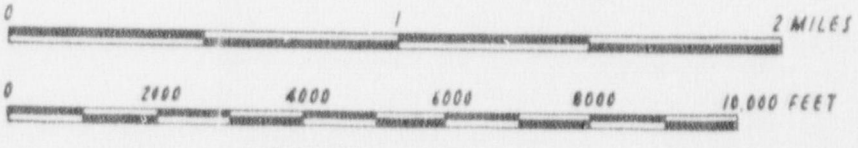
(3) ALIGNMENTS INTERPRETED TO BE AMONG THE "VELOCITY DIFFRACTION PATTERNS" ON LINE WTA-12.

(4) INTERPRETED POSITION OF BURIED REVERSE FAULT.

(5) POSITION OF MAIN TRACE OF THE HOSGRI FAULT.



APPROXIMATE SCALE



HORIZONTAL = VERTICAL

TI
APERTURE
CARD

Also Available On
Aperture Card

PLOT OF REFLECTORS AND OTHER FEATURES ON
WESTERN GEOPHYSICAL COMPANY LINE W74-12 (MIGRATED)

FIGURE 1

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