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MAP OF POTENTIAL GEOLOGIC HAZARDS ON THE NORTH ALEUTIAN SHELF (LEASE SALE 92), BERING SEA

by

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INTRODUCTION

Between July and October 1981, Marine Technical Services (MTS) of Houston, Texas, under contract to the Conservation Division of the U. S. Geological Survey (now the Minerals Management Service), collected approximately 4,000-km of geophysical data in the North Aleutian Shelf area (Bristol Bay) (Data Set AK 19891, National Geophysical Data Center, Boulder, CO.). The purpose of the survey was to provide marine geophysical information for use in support of Outer Continental Shelf (OCS) Lease Sale 75. The information would be evaluated to determine the type and extent of marine geohazards that exist within the sale area. However, Lease Sale 75 was deleted from the current five-year OCS oil and gas leasing schedule and the next scheduled lease sale for this area is Sale 92, scheduled for April 1985.

DESCRIPTION OF THE MTS DATA SET

Geohazards depicted on this map are plotted from a combination of geophysical systems. The systems used were: an array of 1 to 4 15-in^3 water guns; an 800-joule 40-tip sparker; a 3.5-kHz piezoelectric profiler; and side-scan sonar. Data quality varied significantly. Many records suffered from cross-talk and 60-cycle noise. Multiples were present on all medium-penetration seismic profiles, including processed data. The multiple problem made interpretations below the first multiple difficult. The most useful data obtained was from the water gun analog and side-scan sonar systems.

DESCRIPTION OF NORTH ALEUTIAN SHELF GEOHAZARDS

Analysis of the data yielded only three geological conditions that may in some way be hazardous to future petroleum development. These are: 1) numerous scours, which suggest active erosion; 2) faults which appear to have a surficial expression, suggesting present-day activity; and 3) megaripples and sandwaves, suggesting active sediment transport.

Scours

Thousands of scours, many of which are parallel and linear, some of which are incised as deep as 5 meters into sandy seafloor, were identified. Frequently, the scours occur in groups or sets, some sets with more than 200 distinct linear

scours. Many individual scours have minimum lengths of 300 meters, the limit of side-scan sonar coverage. Widths of individual scours range from only a few meters to more than 250 meters.

Orientation of scour sets varies significantly, from shore parallel to shore perpendicular. Some areas contain two discrete sets of overlapping scours with each set having its own orientation. Other areas show a more complex scour system characterized by irregular scours, many having sinuous or free-form shapes.

Current measurements and video observations made on a September 1981 cruise aboard the U. S. Geological Survey Research Vessel S. P. Lee suggest that scouring and sediment transport are both actively occurring. The floors of many scours are covered by a rippled coarse sand or gravel lag. Scours are generally asymmetric in cross section; their shape suggests a concentration of flow due to Coriolis effect, which is accentuated at high latitudes. Possible causes of the active erosion are: tidal currents; topographic acceleration of the water mass caused by constriction over transverse longitudinal ridges which cover much of the shelf (Austin and others, 1982); currents exhibiting helical flow; storm surge effects; storm waves; and shelf geometry.

In over 50 of the scours, marked with "R" on the map, sediment transport was almost always parallel to linear scour orientation but was quite variable when compared to shoreline orientation and bathymetry.

In addition, the dynamic nature of the bottom is further supported by the fact that while the entire region is heavily fished, in only one area, near latitude 56°20' longitude 161°45' (marked with "T" on the map), were we able to recognize gouges left by deep-sea-bottom trawlers.

Faults

Faults that appear to reach the seafloor or that extend upward into the bubble pulse were observed at nine locations, with the greatest concentration west of Amak Island. No seafloor scarps were noted in association with any fault. Rather, many of the faults appeared to be associated with broad surficial sags. Active sediment transport observed in association with the scours may mask the existence of distinct linear surficial scarps.

Bedforms

In the northeasternmost corner of the map area almost all lines show submarine dunes or megaripples. Generally, the bedforms were either megaripples with

parallel or subparallel crests (catenary swept or straight swept in the nomenclature of Allen (1968), or catenary/lunate, both in and out of phase). Spacing of parallel megaripple crests ranges from about 25 to 40 meters.

Other Hazards

Examination of the geophysical data set showed no evidence for the existence of submarine sliding or slumping, shallow gas-charged sediment, surface pockmarks or craters, ice-related erosional features, or any conditions other than those identified earlier that could present problems to future petroleum operations.

REFERENCES

Allen, J. R. L., 1968, Current ripples: Their relation to patterns of water and sediment motion: North Holland Publishing Company, Amsterdam, 433 p.

Austin, W. A., Molnia, B. F., and Schwab, W. C., 1982, Bathymetric map of the North Aleutian Shelf, Bristol Bay, Alaska: U. S. Geological Survey Open-File Report 82-1035, 1 sheet, scale 1:250,000.