

shelf level. The lower part of the continental margin (continental slope) increases in average declivity from about 1° to 10°, and is modified by numerous ridges, hills, benches, and valleys.

Stratigraphic, structural, and geophysical data suggest that during the Tertiary as much as 20,000 feet of sediment accumulated off the central coast of Oregon in the area of the present continental shelf.

Recent sediments in this region consist of well-sorted, fine to very fine, detrital sands on the inner shelf, grading to poorly-sorted glauconite-rich clayey silts on the outer shelf. Continental slope sediments are primarily clayey silts containing small percentages of Foraminifera, radiolarians, diatoms and sponge spicules.

Lithologic and faunal similarities of the Recent sediments to sedimentary rocks exposed along the coast and on the shelf and slope indicate that deposition during late Tertiary time occurred in shelf and slope environments. The fossil faunas also indicate that parts of the continental margin may have been uplifted as much as 4,000 feet since the late Tertiary, and that there has been a general westward shifting of the sites of sediment accumulation.

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#### PALYNOLOGY OF MODERN SEDIMENTS, GULF OF CALIFORNIA AND ENVIRONS

Several hundred bottom samples from the Gulf of California, distributed systematically over its entire area, and comparable samples from streams and arroyos in all surrounding areas, have been analyzed for spore and pollen content and for qualitative and quantitative relationships of various groups of these palynomorphs to each other and to other associated organic entities of comparable size.

Some of the more conspicuous concentration patterns of these palynomorphs indicate distance from shoreline, current patterns, depth of water, coarseness of sediment, seasonal wind patterns, and some source-vegetation distribution areas. Other distribution patterns are complicated by unidentified factors or combinations of factors among which the principal controlling agency is not discernible.

Conspicuous concentrations of spores occur off the mouths of the major tributary streams, adding evidence to the conclusion that stream transportation plays an important role in spore distribution. Spores from the mainland, particularly from the slopes of the Sierra Madre Occidental, reach the Gulf principally by way of the streams because the prevailing winds would not contribute extensively from this direction. A heavy concentration of palynomorphs off LaPaz is due in part to the effects of wind distribution from the tropical vegetation on the southern tip of the Baja Peninsula and in part to the interruption of the long-shore currents by the configuration of the structurally controlled southern tip of the peninsula and by the position of some offshore islands.

There is generally an increase in total number of palynomorphs seaward from very low amounts in the narrower belt of shallower coastal waters, and then a gradual diminution toward the center of the Gulf. The pollen frequency is less in the very shallow areas and in the very deep basins. Relative frequencies of spores are about the same for the various types of sediments except the coarser types. Some correlation of patterns of palynomorphs and radiolarians is indicated, but there is no clear relation of spore patterns to the distribution of diatoms and some other organisms.

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#### DEFINING A GRADIENT IN A SAMPLE OF SEDIMENTARY ROCK

Three orthogonal planes (two vertical and one horizontal with respect to the recognizable bedding structure) of a core sample of apparently graded graywacke sandstone have been petrographically analyzed in order to determine the characteristics of the lithologic gradients in the specimen.

Compositional and textural properties were sampled in thin section according to an orthogonal grid pattern on each of the three faces.

Variability among rows and columns (plus interaction) with respect to each petrographic variable was tested by analysis of variance using a two-cross classification. A larger number of properties show significant variability among rows (in a vertical direction) in the two vertical planes of the specimen than in the horizontal plane.

Quality control models with confidence limits which expose graphically the trends displayed by individual constituents indicate that feldspar proportion, mica proportion, and quartz grain size show significant gradients in the vertical direction perpendicular to the bedding. Quartz proportion oscillates in a non-systematic fashion, and quartz grain shape shows no trend in the vertical planes of the specimen. The petrographic variability observed in the horizontal plane of the bedding is generally trendless. Independence of the individual gradients is apparent, reflecting the influence of explicit processes on the spatial distribution of the petrographic variables in the rock.

Partial trend surfaces show the trends in quartz grain size to be dominant, according to the comparative amounts of variance accounted for by each fitted surface. Again, the major portions of variability are explained by the surfaces in the planes perpendicular to the bedding. The textural homogeneity of the rock in the horizontal (bedding) plane is reflected in the minor trends defined by the surfaces in this direction.

These results indicate that only apparent gradients in the lithologic properties of the rock are detectable by these methods. To assess accurately the "real" gradients, rotational transformations, which would bring the faces into complete orthogonality with the trend, and criteria (such as maximum variance explained) should be employed.

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#### DIAPYRIC STRUCTURES AND UPPER PROTEROZOIC TO LOWER CAMBRIAN SEDIMENTATION IN THE FLINDERS RANGES, SOUTH AUSTRALIA

During deposition of the Adelaide System (Upper Proterozoic) and Lower Cambrian Series, which together exceed 50,000 feet in thickness, an incompetent dolomite-siltstone sequence (Callanna beds) formed piercement structures which influenced sedimentation.

More than thirty discrete diapiric structures occur along fairly well-defined trends which are regarded as a basement fault system. Surface diameters of the eroded cores of the domes range up to several miles but the injection of carbonate-siltstone breccia has caused complication of some folds and resulted in irregular bodies with dike-like tongues.

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