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Ocean To Continent Transition

by

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ABSTRACT

Geophysical data available for the continental margins of North America, South America, Africa, and Europe are examined and summarized. Seismic reflection profiling provides much detail of the uppermost sedimentary cover; seismic refraction data delineate the broad outlines of the upper crustal layers; and gravity data restrict the choices of the deeper crustal structure and that of the upper mantle.

Conclusions about the variability of the sedimentation at the various continental shelves, slopes, and rises are given. The transition zone between continental and oceanic structure is restricted to a narrow zone varying between 50 km and 300 km in width for various coasts. This transition zone is localized in the region of the 2000 m isobath for all the coasts studied. The continental margins are generally in isostatic equilibrium as a whole, although departing from this equilibrium somewhat, especially in the transition zone.

Biographical Sketch - DR. J. LAMAR WORZEL

J. Lamar Worzel received a B.S. degree in engineering physics from Lehigh University in 1940, an M.A. degree in 1948, and a Ph.D. degree in 1949 from Columbia University. He was a research associate at the Woods Hole Oceanographic Institution at Woods Hole, Massachusetts throughout the World War II years, and he joined the Department of Geology, Columbia University in 1949. By 1957 he had risen to the rank of Professor. In 1959 he was made Assistant Director of the Lamont-Doherty Geological Observatory, and became Associate Director in 1964.

Professor Worzel has served on committees for various government agencies and scientific societies including the Deep Water Sound Propagation Committee and the Panel on Seismology and Gravity of the International Geophysical Year National Committee. In 1964 he was awarded the U. S. Navy Meritorious Public Service citation for valuable contributions to the Department of the Navy in scientific investigation.

He is Chairman of the Special Study Group #4.20 (Gravity Measurements at Sea) of the International Union of Geodesy and Geophysics and a member of Special Study Groups #2 and 11 of the International Union of Geodesy and Geophysics, the Research Committee of the SEG, the Committee on the Geophysical and Geological Study of Continents of the AGU, and the Committee on Geophysical Measurements of the National Oceanographic Data Center. He is Director and Treasurer of the Palisades

Geophysical Institute and a member of Pi Mu Epsilon, Tau Beta Pi, Sigma Xi, American Physical Society, SSA, SEG, and the Cosmos Club. He is a Fellow of the GSA, AAAS and the AGU.

Dr. Worzel has been one of the leaders in introducing geophysical techniques into oceanography. He pioneered in introducing underwater photography, continuous soundings, long-range sound transmission, seismic refraction in shallow water, seismic refraction in deep oceans, gravity measurements on surface vessels at sea, reflection profiling at sea, and satellite navigation to oceanography. These techniques have now all been generally adopted as standard in oceanography.

He participated in thirty-eight expeditions at sea, acting as Chief Scientist in all or part of thirty. He organized submarine gravity measuring cruises which covered a large part of the oceans of the world on twenty-five U.S. and British submarines, participating in six of these cruises.

His studies have made significant contributions to underwater sound transmission, the structure of the continental shelves, crustal-mantle boundary structure, seamounts, computation of gravity anomalies from crustal structures, the interpretation of gravity anomalies in terms of crustal structure, identifying a major volcanic event of great extent in the Pacific, structure of mid-oceanic ridges, and the sediments and structural history of the Gulf of Mexico. He introduced gravity measurements on surface ships and gyro-stabilized platforms enabling regional gravity measurements at sea to be made of comparable accuracy to those on land. Dr. Worzel and his associates have made the most thorough analysis of factors affecting ship gravity meters and have developed means of making the necessary observations and corrections for these effects.

The submarine gravity measurements for which he and his students were responsible have been summarized and interpreted in his book, "Pendulum Gravity Measurements at Sea 1936-1959", published in 1965 by Interscience.

Professor Worzel was the principal investigator in 1964 of the first JOIDES (Joint Oceanographic Institutions Deep Earth Sampling) project, when six holes were drilled on the continental shelf and its extension, the Blake Plateau. At that time, besides extensive Tertiary scientific findings, fresh water and phosphorite deposits were discovered.

He played a major role in organizing JOIDES and served on many of its panels, including the Executive Committee, the Planning Committee, the Pacific Coastal Panel, and the Gulf Advisory Panel. He was personally engaged in the difficult initial phases of sea trials and deep sea drillings. As co-Chief Scientist of Leg 1, he was involved in the many new firsts achieved: the hole drilled in the deepest water (2,800 fms); the deepest subbottom hole in the deep ocean (2,500 ft); proof of the existence of salt domes on the deep ocean (2,000 fms, Gulf of Mexico); discovery of petroleum in deep water; discovery that many of the deep sea reflecting horizons are cherts; and sampling of the oldest deep sea sediments yet found (Jurassic). The thirteen holes drilled on Leg X, on which he was also co-Chief Scientist, added considerably to the knowledge of the ocean structure as well as that of petroleum and chert in the Gulf of Mexico.