LATE CRETACEOUS EUGEOSYNCLINAL SEDIMENTATION, GRAVITY TECTONICS, AND OPHIOLITE EMPLACEMENT IN THE OMAN MOUNTAINS, SOUTHEAST ARABIA

The Oman Mountains border the Gulf of Oman from the Arabian Sea to the mouth of the Persian Gulf. The Jebel Akhdar anticline forms the central core of these mountains and exposes a section from the Precambrian nucleus to late Tertiary aged strata on the flanks. Intercalated in this sequence, between well-dated late Cretaceous sediments, is a melange of rocks composed of turbidite limestone, radiolarian chert (Hawasina Group) and massive exotic blocks of Permo-Triassic limestone overlain by a thick sheet of serpentinic igneous rock (Semail igneous series). This association of rocks, known as Steinmann's Trinity has been little disturbed since its emplacement during the Late Cretaceous. The scarcity of Late Cretaceous fossils in the Hawasina, the common occurrence of well-preserved Permian to middle Cretaceous species, and the contorted nature of the strata have led some geologists to postulate that these sediments were deposited outside of their present location during a prolonged pre-Late Cretaceous interval and then tectonically emplaced during the latest Cretaceous. However, it also can be interpreted from field data that the Hawasina is para-autochthonous and was deposited near its present location during Late Cretaceous time.

Regional correlation of autochthonous sections show that northeast Oman was situated far out on the arabian platform where carbonate sedimentation persisted from Permian to Cenomanian time during prolonged regional tectonic quiescence. Sedimentary and tectonic quiescence ended during Late Cretaceous time when the thick Aruma pelagic shale was deposited across northeastern Oman concomitant with major normal faulting.

The distribution, grading, and constitution of the carbonate clastic material in the Hawasina, and the alignment of exotic limestone blocks indicate that the sediment source area was a northwest-southeast-trending uplift of Permian to middle Cretaceus carbonate rocks. Scarcity of terrigenous clastic material and terminal submarine volcanism suggest that the source area was a submerged seamount. Erosion from this high is believed to have been by means of turbidity currents activated by repetitive block-fault movement over a rising mantle diapir.

Hawasina sediments compare with present deep-water sediments in the Puerto Rico Trench where faunally barren siliceous oozes of abyssal facies are interbedded with calcareous turbidites rich in reworked older and contemporaneous shallow-water fauna. The absence of contemporaneous (Late Cretaceous) shelf fauna in the Hawasina is attributed to the seamount source area being deeper than neritic, whereas the absence of contemporaneous pelagic calcareous fauna was the result of dissolution below the carbonate compensation depth. One of the most controversial problems in Oman is the dating of melange sediments which are heavily contaminated with reworked fossils.

The deep trough which received Hawasina sediments appears to have been bounded by a steep block-faulted northeastern limb whereas the southwestern limb became shallower gradually through the Aruma belt to the Arabian carbonate platform. At the close of Hawasina time, volcanism and catastrophic tension relief faulting dislodged the remnants of Permo-Triassic limestone from the roof of a mantle diapir, and these descended into the trough as huge gravity slides (e.g., Jebel Kawr, 250 sq mi), leaving the seamount as a denuded basement uplift. Regional tension relief was accomplished finally by crustal separation and flood eruption of Semail ultrabasic pillow lavas onto the abyssal landscape.

Exploration for simple structures in the autochthonous Cretaceous limestones which subcrop the Hawasina is hampered by seismic energy attenuation and velocity problems. It is probable that simple block faulted structures such as the Fahud and Natih fields may underlie the contorted Hawasina cherts.

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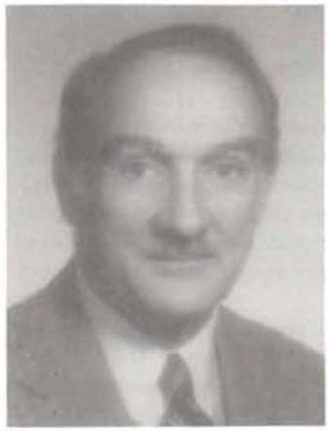
H. HUGH WILSON—Biographical Sketch



H. Hugh Wilson is a senior consulting geologist for the Middle East and East Africa regions, for Sohio Petroleum Company International. He received a B.S. degree, with honors, in natural science (geology major) from Dublin University in 1950 and an M.S. degree in geology from the same university in 1952. Upon graduation, Mr. Wilson joined Royal Dutch Shell and spent the next 17 years in various areas of the world: as field geologist in Colombia, chief geologist and head of exploration in Turkey, exploration manager in Guatemala, exploration manager of the Arabian Gulf and Oman area, general manager of exploration and production in Australia, and in management programs in London. In 1969, he transferred to Shell U.S. where he worked primarily the Gulf Coast area. In 1973, Hugh resigned from Shell to join a consulting firm in New Orleans, and later became a consultant to Louisiana Land and Exploration Company. After six years of looking after worldwide projects for LL&E, he formed his own consulting firm, Vanguard Exploration. In 1983 he joined Superior Oil as a staff explorationist and in August of 1984 went to work for Sohio in international exploration.

Mr. Wilson has published papers on a wide range of technical topics and geographical areas. These papers appeared in such publications as AAPG bulletins, Geology Magazine, Journal of the Institute of Petroleum, GCAGS Transactions, and the Journal of Petroleum Geology. The areas covered by his papers have included the U. K., Guatemala, British Honduras, the Oman Mountains, the Gulf of Mexico, Saudi Arabia, and Mexico. He has dealt with such diverse subjects in his papers as salt tectonics, diagenetic traps for hydrocarbons, orogenic pulses, and timing of hydrocarbon expulsion. In addition, he has been a lecturer for the Advanced Petroleum Geology courses at Tulsa University and for in-house exploration seminars within oil companies. He was key speaker at the GSA Penrose Conference on Geodynamics of Continental Interiors, and has been guest speaker at geological societies in California, Louisiana and Texas. He has served as Associate Editor of AAPG and was a team member of the International Geodynamics Project working on global synthesis of evidence leading to the reconstruction of distribution of continents and oceans through time.

Mr. Wilson is a fellow of the Geological Society of London and the Institute of Petroleum in London. He is a member of the Geological Society of America, the American Association of Petroleum Geologists, the American Association for the Advancement of Science, the Australian Petroleum Exploration Association, the New Orleans Geological Society, and the Houston Geological Society.