MEETINGS

HGS DINNER MEETING— SEPTEMBER 11, 1989

THOMAS H. NELSON—Biographical Sketch

Thomas H. Nelson is president of Salt Tectonics International, Inc., a consulting firm which specializes in workshops, evaluations and interpretations of salt structures for the petroleum industry.

Tom received his Bachelors Degree in geology in 1953 from Brown University. He initially worked for Shell in the Gulf of Mexico. In 1956 he began a career with various Exxon affiliates which spanned more than 31 years. His assignments included both exploration and research and were mainly related to salt tectonics in many of the free world's major evaporite basins. In the late sixties and early seventies, Tom was instrumental in developing many applications of plate tectonics to exploration for Exxon and was an AAPG distinguished lecturer on this subject in 1972. During the final years of his career, Tom returned to exploration in the Gulf of Mexico where he worked primarily with salt tectonics of the outer shelf and continental slope. Upon retirement from Exxon in 1987, Tom formed his consulting firm and is continuing his work in the field of salt tectonics.

He is a member of AAPG, HGS, SEG, GSA and AGU and served on the editorial board of Tectonophysics from 1979 to 1989.

LEE FAIRCHILD—Biographical Sketch

Lee Fairchild earned his B.A. in Geology from the University of California, Berkeley and his M.S. and Ph.D. from the University of Washington. His thesis research was on the structure and petrology of the Leech River Group on southern Vancouver Island, and his dissertation examined mudflows generated during the May 18, 1980 eruption of Mt. St. Helens. Since joining the Structural Analysis section at Exxon Production Research in 1984, he has focused on salt tectonics.

EMPLACEMENT AND EVOLUTION OF SALT SILLS IN THE NORTHERN GULF OF MEXICO

Laterally extensive, sub-horizontal salt sheets are now widely recognized beneath the continental slope of the northern Gulf of Mexico. Because they overlie significant sections of Tertiary clastics which elsewhere in the region produce oil and gas, these sheets are of great interest to the petroleum industry.

Study of a number of salt bodies in the eastern part of the Louisiana slope has led to the conclusion that they are sills. The sills formed as salt from the tops of near-surface diapirs intruded through the shallow, low density slope sediments at depths of less than 1000 feet below the seafloor. Evidence supporting this conclusion is shown in figure 1. In this figure, a series of reflection terminations is evident to the left of the edge of the salt sill (lower arrow). The

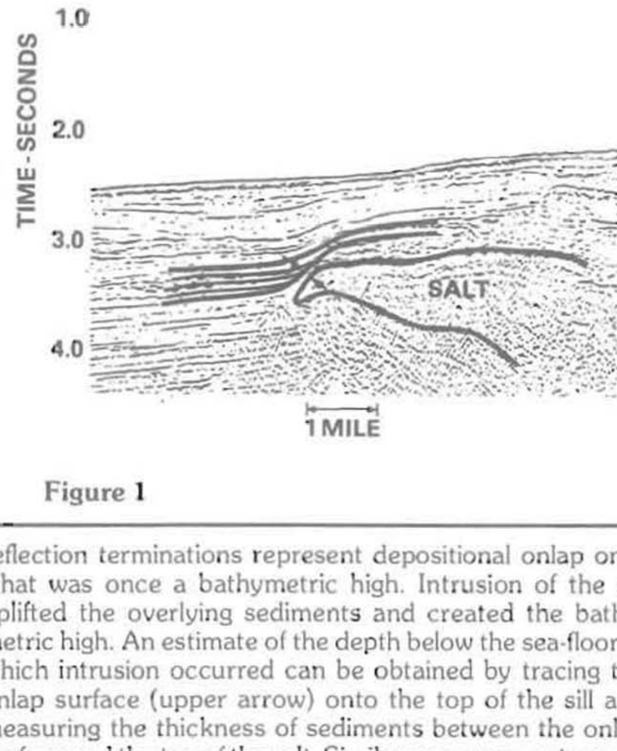

Figure 1

reflection terminations represent depositional onlap onto what was once a bathymetric high. Intrusion of the sill uplifted the overlying sediments and created the bathymetric high. An estimate of the depth below the sea-floor at which intrusion occurred can be obtained by tracing the onlap surface (upper arrow) onto the top of the sill and measuring the thickness of sediments between the onlap surface and the top of the salt. Similar measurements made at 53 different sill edges showed that, in all cases, intrusion occurred at burial depths of less than 1000 feet with a mean emplacement depth of 390 feet below mud-line.

Structural and depositional patterns within the sediments above and around the sills, combined with limited well control, indicate that the sills preferentially intrude into nearly pure muds and spread initially as thin sheets which reach their maximum extent rapidly.

A proposed sequence for sill formation is shown in figure 2. This sequence begins when the density directly over the source salt exceeds the salt density and a diapir begins to form. Assuming the average slope sediment densities, this should occur at about 4900 feet below mudline. Given an adequate supply of salt, the diapir reaches the surface only when the average density of the sediments above the source salt equals or exceeds the density of the salt. On average this requires about 12,000 feet of sediment overburden.

At this point, observation suggests that a sill will be initiated only if the near-surface sediments around the diapir are nearly pure mud. Sediment strength most likely plays a significant role in controlling sill initiation. Once started, the sill spreads rapidly to its maximum extent, probably as a thin sheet on the order of a few hundred feet thick.

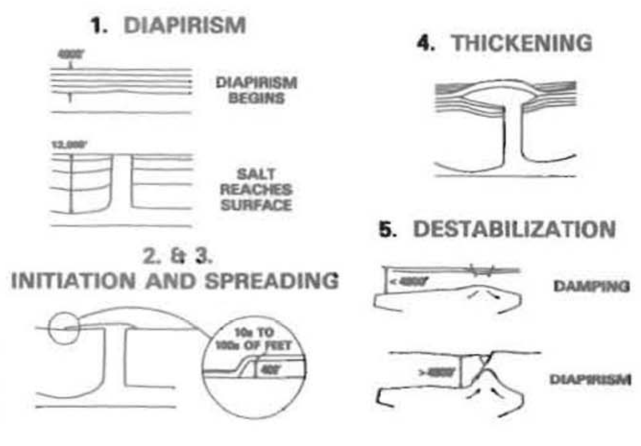

Figure 2

Further salt addition increases the thickness of the sill, but rarely appears to change the extent of the sill. Thickening continues until either the source of deep salt is depleted or a new density inversion is established above the sill.

In either case, when silling stops, remobilization begins. If the salt source is depleted and no density inversion has been established, irregularities on the top of the sill tend to dampen out or become inverted. If a density inversion has been established, irregularities on the sill become focal points for the growth of new diapirs and the cycle begins again.