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HIGH-PRESSURE COMPACTION STUDIES AND CHEMISTRY OF SOLUTIONS SQUEEZED OUT OF MUDS AT DIFFERENT STAGES OF COMPACTION

Remaining moisture content (% dry basis) was determined for various clays (montmorillonite, hectorite, illite, kaolinite, dickite, halloysite), marine mud, and soil samples and plotted versus the logarithm of pressure (up to 500,000 psi.). The straight-line relation at pressures above 40–1,000 psi. (depending on type of clay) suggests that compaction is more or less a simple continuous process in the pressure range studied. The resistance to compression apparently increases with higher packing density and more strongly coalesced structures. Most of the water is squeezed out during a relatively short period of time (1–4 days), and equilibrium is reached after about 7–60 days (depending on type of clay). The calculated (from water loss) permeability of clay at high overburden pressures (15,000–400,000 psi.) is in the order of $10^{-10}$–$10^{-13}$ darcys, values characteristic of nearly impervious soils. Consequently, compaction appears not to be limited by low permeability, but rather by resistance to grain deformation.

The salinity of squeezed-out solutions (using fresh marine mud, various types of clay, and sea water) progressively decreases with increase in overburden pressure. Consequently, mineralization of interstitial solutions in shale should be less than that of waters in associated sandstone. Reliable results in determining the chemistry of interstitial solutions of marine mud require that nearly all fluid be squeezed from each sample and require pressures in the 150,000–400,000 psi. range.

Experiments concerning X-ray analysis of compacted clay for deciphering the magnitude of overburden pressure were inconclusive.

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UPPER SILURIAN CONODONTS FROM WELSH BORDERLAND

In recent years, correlation of the Silurian-Devonian boundary from its type section with areas outside Britain has been the subject of considerable discussion accompanied by some opinion favoring transfer of the Silurian standard to the European mainland. Difficulty arises partly because the boundary in Britain is placed at a pronounced facies change and partly because zonal graptolites, which are widely used to correlate the Silurian in continental Europe and elsewhere, occur in Britain no higher than the middle of the Ludlow. A most significant advance toward clarifying the situation was made in 1964 by Walliser, who published a detailed conodont zonal succession from the Silurian of the Carnic Alps of Austria and related it to the standard graptolite zones in Bohemia and Germany.

In 1963, the authors collected 50 pounds of calcareous siltstone from the upper part of the Whitcliffe Flags at Diddlebury, 6 miles north of Ludlow in Shropshire, and acidized it in order to recover the conodonts present. The 850 specimens that were extracted clearly refer the fauna to Walliser's uppermost Silurian conodont zone, the *eosteinhornensis* zone. This reference indicates that the top of the Ludlovian Series correlates essentially with the top of the Bohemian Budňany (E-beta-two) and implies that the Ludlow and Budňany are approximately equivalent. In terms of graptolite zones, the Silurian-Devonian boundary should occur at the base of the *Monograptus uniformis* zone inasmuch as it marks the upper limit of Walliser's *eosteinhornensis* zone. Walliser, who has studied *eosteinhornensis*-zone conodonts from other localities in Britain, proposes that the Silurian-Devonian boundary in continental Europe be fixed by the earliest occurrence of *Monograptus uniformis*. In this context, the Skala Formation of Podolia (Russia) is essentially late Ludlovian in age as are the Calcaire de Liévin of northern France and the Untere Steinhorn-Schichten of the German Kellerwald.

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STRATIGRAPHIC AND TECTONIC FRAMEWORK OF LIBYA

Libya is situated on the unstable Mediterranean foreland of the African shield. Marine strata of Paleozoic, Mesozoic, and Cenozoic ages abound in northern Libya, but continental rocks of Paleozoic and Mesozoic ages predominate in southern Libya. Several marine incursions, mainly in Silurian, Middle Devonian, Carboniferous, Late Cretaceous, and Eocene times, reached far into the country, some crossing the southern border.

Compression folds are almost wholly absent; however, uplift, subsidence, block faulting, and tilting have occurred, and angular and parallel unconformities are common. The major diastrophic disturbances include the Caledonian and Hercynian, as well as disturbances during Late Cretaceous and Oligocene through Miocene or Recent times.

The chief regional structures are the Gefara-Gabese basin, Hamada basin, Gargaf arch, Marzuk basin, Tibesti-Haruj uplift, Kufra basin, north Cyrenaican uplift, and Sirte basin. Several large flows and intrusions of Cenozoic basalt and phonolite are present. Sand and gravel conceal the bedrock in about a third of the country.

In the Sirte basin, marine sedimentation, differential compaction, reef development, subsidence, and block faulting, beginning in Late Cretaceous time, favored the development of source and reservoir rocks. Recoverable oil has been found chiefly in limestone and sandstone of Late Cretaceous and Tertiary ages, but also is reported in some knobs of lower Paleozoic sandstone and fractured Precambrian granite. In the Hamada basin, many oil accumulations have been found in sandstone beds of several Paleozoic systems. Most or all of the oil discovered to date probably is in anticlinal structures, but accumulations may exist in other types of traps.

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MODERN GRADED BEDS AND TURBIDITY CURRENTS: CASE HISTORY

Modern turbidity-current deposits are well known from the deep sea but, in most areas, core control is insufficient to establish correlation between individual graded beds. Color, texture, and composition of beds