before the conversion of aragonite to calcite and before tectonic fracturing. The magnesium content of protodolomite ranges from 41.5 to 47.5 mol. % $MgCO_3$. It is influenced by depositional environment and the calcite/dolomite ratio of the individual sample. Dolomitization is selective. Dolomitization affects first the high-clay matrix, second the low-clay matrix, third the aragonitic calciclastics, and last the calcitic calciclastics. The original aragonite content in the carbonates is extremely important for the material balance during diagenesis.

Large scale replacement of protodolomite by calcite, encountered in one oil field, is related to weathering prior to a transgression. Intensive late diagenetic cementation by mostly calcite occurred before and following oil migration.

Dolomites with high diagnetic porosity are the main reservoir rocks. Undolomitized calcarenites with original high intergranular porosity form a secondary reservoir rock type. The reservoir properties of the Gigas beds change markedly in isofacies and isodolomite areas as a result of the variable intensity of the late diagenetic cementation. The occurrence of reservoir rocks is determined by the local coincidence of favorable facies with favorable diagenesis.

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SEDIMENTS OF THE CAICOS CONE, BAHAMAS

A large sedimentary ridge extends east of Caicos Passage (Bahamas) toward the Silver Abyssal Plain. This asymmetrical ridge is steepest on the south side and lies parallel with the Bahama Banks. Small V-shape depressions observed on the crest and north slope may be submarine channels. Three 6-meter-long cores taken at approximately 2,850 fathoms consist of pelagic clays (illite and chlorite) with interbedded calcarenites. The calcarenites consist of foraminifera (benthonic and pelagic), pteropods from both noritic and littoral depths (indicating considerable displacement of fauna), and finer material. Primary structures such as graded bedding, cross-bedding, convolute bedding, and parallel bedding were observed in the turbidite beds. Considerable mechanical sorting of faunal species due to differential settling in a single sequence resulted in two distinct sediment facies; the lower consisting of foraminfera and pteropod tests and the upper consisting of clay, discoasters, and coccoliths. The pelagic sediments of the three cores show close correlation in their variation of carbonate content. These variations may reflect climatic changes.

A single stratigraphic sequence is seen in the three cores. Each has a similar carbonate curve, similar sequence of manganese-stained layers and a similar sequence of sediment colors. One correlative calcarenite thins from 24 cm. to 13 cm. and the mean grain size decreases from .04 mm. to .018 mm. as distance from the probable source increases by 50 miles.

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HIGH-PRESSURE STUDIES IN THE SYSTEM $MgO—SiO_2$ AND THE CONSTITUTION OF THE UPPER MANTLE

The compositions $MgO \cdot SiO_2$ (enstatite) and $2MgO \cdot SiO_2$ (forsterite) were studied over the pressure range 20 to 130 kilobars at temperatures between 500° and 1,200°C. This pressure range corresponds with depths of about 75–400 km. which include part of the 200–900-km. seismic discontinuity zone in the upper mantle.

Orthoenstatite is the high-pressure high-temperature polymorph, and clinoenstatite is the high-pressure low-temperature polymorph. The equilibrium boundary for the orthoenstatite-clinoenstatite transition intersects the temperature axis at 540°C.; at 100 kb the equilibrium temperature is 870°C. At 115 kb and 600°C. clinoenstatite breaks down to forsterite plus stishovite. Forsterite is stable to at least 130 kb.

The experimental results: (1) support Birch's (1952) hypothesis that the inhomogeneous region in the upper mantle is due to pressure-dependent phase transformations; (2) confirm Ringwood's predictions that (a) enstatite breaks down to forsterite plus stishovite at about 120 kb, and (b) higher pressures are required for the forsterite-spinel inversion; (3) explain, when coupled with the results of Bowen and Tuttle (1949) on the system $MgO—SiO_2—H_2O$, the absence of clinoenstatite in terrestrial rocks and its occurrence in meteorites; and (4) explain the experimental results of Turner, Heard, and Griggs (1960) which show that orthoenstatite may be transformed to clinoenstatite by deformation; the latter exemplifies the Becke concept of shear-induced diaphthoresis.

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GENESIS OF SILICA CEMENT IN SANDSTONES AND ITS REPLACEMENT BY CARBONATES

Paragenetic history of the cementation observed in many sand-carbonate rocks can best be explained by understanding the complex physical-chemical changes which cause the precipitation and solution of cements in sediments.

Beta quartz and other metastable forms of SiO_2 are widely distributed by sedimentary processes and commonly make up a considerable volume of some sediments. Several sources of silica are available: (1) abrasion of siliceous sediments along beaches, (2) siliceous tests, and (3) eolian quartz dust. Silica contributed by these sources forms silica cements in sediments.

Three zones of diagenesis beneath the depositional interface may be recognized, each with differing chemical and physical characteristics. The metastable forms of SiO_2 are dissolved in the upper zone because the trapped sea water is universally undersaturated with respect to these phases. In the middle zone, alpha quartz precipitates as silica cement and overgrowths when the conentration of SiO_2 of the interstitial fluid rises above 14 ppm. This is due to the higher solubility of the metastable forms of SiO_2 (up to 140 ppm.) than that of alpha quartz (14 ppm.).

In the lowest or third zone, carbon dioxide concentration decreases while the temperature and pH increase slightly. These conditions favor precipitation of carbonate rocks and the solution of silica.

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TEST OF THE DISCRIMINANT FUNCTION IN THE AMPHIBOLITE PROBLEM

Amphibolites from Chandos Township, Peterborough County, Ontario, were classified by field criteria as