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PORE-WATER CHEMISTRY AND EARLY DIAGENESIS OF NEARSHORE MARINE SEDIMENTS

Pore-water chemistry and mineralogy of carbonate and terrigenous sediments from Kaneohe Bay, Oahu, Hawaii, were analyzed to determine differences in pore-water compositions, in nature and extent of early diagenetic reactions, and in fluxes of constituents between these sediment types. Pore waters, extracted at *in-situ* temperatures and analyzed for pH and concentrations of Ca^{++}, Mg^{++}, K^+, Na^+, Cl^-, $SO^=_4$, reduced sulfides, SiO_2, NH^+_4, PO_4, NO^-_3, and Sr^{++}, of 23 1-3-m gravity cores show chemical gradients of dissolved species with sediment-burial depth.

The sediment pore waters are anaerobic, exhibiting an increase in reduced sulfides, H^+, and alkalinity and a decrease of $SO^=_4$ with depth. Owing to reactions resulting in the formation of diagenetic ferrous sulfide, the pH's of terrigenous sediment pore waters are higher at an equivalent depth than those of carbonates, whereas reduced sulfides are lower and sulfate reduction is more rapid.

Calcium and Mg^{++} are removed from pore waters with increasing depth as a result of (1) formation of protodolomite, *or* (2) precipitation of calcite and substitution of Mg^{++} for Fe^{++} in clay minerals resulting in formation of ferrous sulfide ("Drever reaction"). Dissolved SiO_2 increases with depth by solution of siliceous plankton or amorphous aluminosilicates, whereas NH^+_4, $PO^{\equiv}_4$, and NO^-_3 increase with depth because of bacterial oxidation of organic matter. Sodium, K^+, and Cl^- vary sympathetically, reflecting the original salinity of the pore waters.

Lateral gradients of dissolved species in bay pore waters reflect the fact that the southern end of the bay is a more efficient trap for organic matter. These gradients imply a lateral component of flux of dissolved constituents.

This study shows that (1) calculations of fluxes in and out of marine sediments must take into account variability of pore-water compositions and fluxes among sediment types, and (2) nutrient regeneration in pore waters can be a significant source of nutrients to overlying waters, whereas reduced sulfide fluxes may be significant enough to inhibit infaunal and epifaunal growth.

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SEDIMENTARY ENVIRONMENTS, PENNSYLVANIAN AND EARLY PERMIAN, SOUTHEASTERN ARIZONA

In southeastern Arizona, Pennsylvanian and Early Permian strata have 15 complex transgressive and regressive cycles. Sedimentary environments were influenced primarily by a stable central Arizona shelf (divisible into Papago inner shelf, San Pedro outer shelf, and Mogollon inner shelf) and an unstable Pedregosa basin on the southeast.

Morrowan and earliest Derryan deposits (Black Prince Limestone) have a basal red clastic unit overlain by thin, sheetlike carbonate units. During late Derryan and early and middle Desmoinesian deposition (lower part of Horquilla Limestone), successive carbonate banks separated the 3 parts of the central Arizona shelf, but there was little differentiation of sediments on the San Pedro outer shelf and in the Pedregosa basin. During the latter part of the Desmoinesian, a clastic influx from the north initiated carbonate-poor depositional cycles.

Missourian and Virgilian deposition (upper part of Horquilla Limestone) produced more clearly differentiated carbonate-bank margins around the Pedregosa basin and San Pedro outer shelf. Northward, these strata become dominantly clastic and pass into interdistributary bay and lagoonal deposits and supratidal, deltaic redbeds and conglomerates of the Supai Formation.

Wolfcampian depositional environments (part of Supai and Earp Formations) shifted southeast with time. On the Mogollon inner shelf, supratidal deltas and gypsiferous lagoonal deposits form this part of the Supai Formation; and on the San Pedro outer shelf, shallow-shelf sandstones, siltstones and shales intertongue with a few thin limestones. Massive, lenticular carbonate banks enclosed the Pedrogosa basin, and within the basin, dark fetid clastics and carbonates suggest restricted environments. Latest Wolfcampian or early Leonardian sediments (part of Supai and Earp Formations) are sandy dolostones and siltstones with impoverished faunas that suggest a series of poorly aerated lagoons.

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INTERSTITIAL WATERS, MINERALOGY, AND DIAGENESIS OF SHALES, DARE COUNTY, NORTH CAROLINA

The Atlantic coastal plain of North Carolina contains a complex stratigraphic sequence of Mesozoic and younger rocks. Sidewall cores were taken in the shale sequences of 2 closely spaced wells for analysis of their mineralogy and interstitial waters. In both wells, interstitial waters from all shales are less saline than sea water—even in those shales that are distinctly marine. Typical samples from the first well are mostly NaCl; sulfate is commonly high—around 4,000 ppm or more, and calcium also is above its seawater concentration. The waters in the adjacent sands, which are calculated from logs and assumed to be NaCl, have salinities that range from 30,000 to 40,000 ppm. There is no regular relation between salinities in shales versus the associated sands.

In the second well, interstitial waters in corresponding shales are of equal or lower salinities, in some only half as saline as in the first well, and contain more nearly pure NaCl. However, the salinity in the adjacent sands is always greater than 40,000 ppm and increases with depth to over 100,000 ppm. Thus, the correlative shale and sand beds in these 2 wells contain very different interstitial waters. There is no obvious geologic explanation for the different diagenetic history. The mineralogy of all shales is similar, with kaolinite, montmorillonite, and quartz predominant, illite always present, and calcite sparingly present. Neither salt nor gypsum was present in the second well, although many samples in the first well are nearly saturated with gypsum. Temperatures are not especially high, and there is no evidence for extensive mineral diagenesis.

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GEOLOGIC INTERPRETATION OF RADAR AND SPACE IMAGERY OF CALIFORNIA

Side-looking airborne radar (SLAR) imagery in California is interpreted in terms of geologic structure and rock type. Field checks and comparison with published geologic maps indicate some revisions of existing maps. In particular, linears on the radar imagery point to previously unmapped faults. In outcrops where surface texture is related to bedrock lithology, the radar signature may indicate rock type.

The unmanned Earth Resources Technology Satellite (ERTS) telemeters multispectral-scanner imagery that is reconstituted into reflected-infrared-color imagery. With respect to radar imagery, the ERTS imagery has poorer spatial resolution and smaller scale; nevertheless, useful regional patterns may be interpreted. Repetition of ERTS imagery on an 18-day cycle should enable us to determine the season for obtaining maximum geologic information.

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MAP OF PARTS OF FLOOR OF SANTA BARBARA