ortho-amphibolite, para-amphibolite, or of uncertain origin. Following analysis for major and 8 trace elements, discriminant functions were calculated for the ortho and para groups, and used to classify rocks in the uncertain category.

Using analyses of Ti, Al, Fe^{+3}, Fe^{+2}, Mn, Mg, Ca, P, CO_2 in 11 rocks in each group, the discriminant function gives a probability of misclassification of 5.4%.

Analyses of Cr, V, Ni, Co, Sc, Sr, Ba, Zr on 20 rocks in each group gives a discriminant function with 5.7% probability of misclassification.

Ti, Fe^{+2}, Mn, P, Co, and Sc are the most effective elements for discrimination.

It is not yet certain whether this approach will have universal applications regardless of the geological setting of an amphibolite.

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Formation of Recent Dolomite in Florida and the Bahamas

Recent dolomite in the process of formation has been discovered on exposed mud flats of the Bahama Islands and in smaller areas of the lower Florida Keys. On western Andros Island, up to 80 per cent dolomite occurs at or near the surface in an area covering hundreds of square miles. In both the Bahamas and the Florida Keys (Sugarloaf Key), the site of formation is inches above mean high tide level.

The dolomite crystals, <3 microns, occur in pelleted muds and skeletal and oölitic sands that are associated with laminations, stromatolites, mud cracks, and burrows. The concentration of dolomite increases as the soft sediments are progressively lithified. Partly dolomitized gastropod shells and pellets show that the dolomite is a penecontemporaneous replacement of calcium carbonate. Radiocarbon age determinations by Martin and Deffeyes (personal commun.) prove that the exposed dolomite is contemporary.

The dolomite occurs where alternate flooding and drying together with upward capillary movement provide a continual supply of magnesium from sea water. Surface evaporation intensified by a dark algal mat increases the concentration of dissolved salts, but in this humid climate no evaporites are preserved during dolomitization. With subsidence this unique zone periodically supplied with marine sediment and soaked in concentrated sea water can persist to form significant thicknesses of dolomite. Already in only 5,000 years up to 5 feet of Recent dolomitic sediment has formed in parts of the Bahamas.

This Recent dolomite may be called "primary" but actually it originates by replacement of calcium carbonate. Its occurrence in sediments with mud cracks, stromatolites, burrow mottling, and boudinage-like structures indicates that it may explain many ancient dolomites with similar structures.

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Carbon Isotope Geochemistry of Petroleum

Carbon isotope studies of ancient and modern natural organic materials have helped reconstruct the geochemical history of petroleum and gas accumulations. Similarity of C^{13}/C^{12} ratios of petroleums, and of the lipid fraction of plants, suggests that petroleum is derived from lipids, which are the most stable organic constituents of organisms. C^{13}-content of petroleums derived from marine organisms is typically higher than that of petroleums of non-marine origin. This difference is a reasonable consequence of the fact that marine organisms have higher C^{13}/C^{12} ratios than do non-marine organisms.

Typical gas phase hydrocarbons associated with liquid petroleums have C^{13}/C^{12} ratios that are 10–22 per mil lower than those of the associated liquid phase components. In contrast, methane produced by bacterial decomposition of more complex organic matter is 40–70 per mil lower in C^{13}/C^{12} ratio than the organic matter from which it formed. The isotopic composition of narrow distillation fractions of the liquid petroleum phase implies that the low molecular-weight hydrocarbons in the gas and gasoline fractions are formed by decomposition of higher molecular-weight petroleum components.

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Sediment Structures Generated by Flow in Alluvial Channels

The forms of bed roughness which are molded from the bed material by the flow in alluvial channels are broadly classified by their shape and their effect on flow resistance and by the mode of bedload transport associated with the bed form. The most common forms of bed roughness include ripples, dunes, a transition roughness as the dunes change to a plane or flat bed, plane bed, standing waves, and antidunes. The forms of bed roughness change from ripples to dunes and ultimately to antidunes as the tractive force is increased.

The physical relationships between form of bed roughness and the variables upon which form roughness depends are extremely complex. The independent variables are interrelated so that it is impossible to completely isolate the effect of a single independent variable on form roughness in a flume or stream. Important interrelated variables include: characteristics of bed material such as physical size, fall diameter and gradation; the temperature or fluid viscosity; the concentration of very fine sediment; and the depth as well as other flow variables. Methods of predicting forms of bed roughness from known characteristics of the flow and sediment are inexact, but as a first approximation, the bed roughness is related to stream power and median fall diameter of bed material.

Different types of cross-bedding are associated with the various roughness elements, based on equilibrium flow conditions in recirculating flumes. The tendency for all flows to meander, even in straight channels, complicates both the forms of bed roughness and the types of cross-bedding. This tendency to meander is reinforced by the large bars which exist adjacent to one bank and then the other on the beds of alluvial channels. These bars may be of such small amplitude to go almost unnoticed in a given system, particularly when small width-depth ratios exist. However, if by reducing depth or by widening the channel the width-depth ratio is increased, these large bars may develop to almost the full depth of the channel. The regular forms of bed roughness are in general superposed on these large bars, but the roughness forms change dramatically as the depth, velocity, and direction of flow change over the bar as deposition and development of the bars progress.