or absent. Large amounts of carbonaceous matter seem to enhance the development of preferred orientation, perhaps by its ability to retain large amounts of water. Specific effects of other factors on clay fabric are less well known, but one might expect the development of preferred orientation to be enhanced by decreasing concentrations of interstitial electrolytes, decreasing valence of exchangeable cations, and decreasing acidity.

The main influences on the porosity of sand are the textural characteristics of the constituent particles: size, sorting, roundness, shape, and flexibility. Well-sorted sand has greater porosity than poorly sorted sand. Angular sand has greater initial porosity and is more compressible than rounded sand of the same size. Admixtures of platy mica particles increase the porosity, compressibility, and elasticity of sand.

The influence of most of these factors—except for particle size—is inferred from laboratory experiments on simple systems. Little is known of their relative importance in complex natural sediments.

MERRIAM, DANIEL F., State Geological Survey of Kansas, Lawrence, Kansas, and HARBAUGH, JOHN W., Stanford University, Stanford, California

PROCESS-RESPONSE MODEL FOR MARINE-ORGANISM COMMUNITIES

Computers can be used to mimic ancient marine-organism communities with surprising effectiveness.

In a series of special programs designed for the I.B.M. 7090/7094 computers, fossil communities and their environments have been symbolically simulated in a three-dimensional mathematical model. In constructing the model, each community was assigned specific properties which governed their response to environmental factors such as depth of water, distance from shore, substrate, turbulence, turbidity, temperature, and salinity. The environmental conditions in turn were varied by adjusting numerical data fed to the computer which regulated the model.

The properties assigned to the computer communities were finely adjusted by trial and error in order to make them "behave" more or less like their actual counterparts, adapting to changing conditions and even competing with each other. One of the most useful aspects of the program was the ability to advance the model through increments of geologic time where the responses of the communities and the long-term effect of environmental and evolutional factors could be observed in a way heretofore not possible.

Recent work with the model has dealt with environmental responses of leaf-like calcareous algae of late Paleozoic age. These algae were widespread in shallow Pennsylvanian and Early Permian seas, locally creating thickened banks or reefs. Today, some of these reefs serve as large oil reservoirs in southeastern Utah, northern Oklahoma, and West Texas. Exploration for such reservoirs will be greatly enhanced if the environmental response of the organisms that created them can be experimentally determined and this knowledge effectively used for exploration purposes.

MIDDLETON, GERARD V., McMaster University, Hamilton, Ontario

TURBIDITY-CURRENT EXPERIMENTS

Experiments were performed in the W. M. Keck Laboratory, California Institute of Technology, using a lucite channel 5 meters long, 50 cm. deep, and 15.4 cm. wide. Turbidity-current "surges" were produced by releasing suspensions of plastic beads from a lock at one end of the channel. The bottom of the flume was horizontal and before release of the suspension the water level was the same within the lock and the main channel; the experimental results may therefore be compared with the results obtained by Keulegan (1958) for saline surges. Experiments were performed at two depths (20 and 30 cm.), and two suspension concentrations (about 25% and 45% concentration by volume) were used. The sediment consisted of perfectly spherical plastic beads with a density of 1.52 and an average size of 0.18 mm. The results show that the shape of the head, the initial velocity, and the relation between the velocity of the head and its thickness and density are very similar to those reported for saline surges. The velocity of the head is given by the equation

$$V = C\sqrt{g'd_2}$$

where $g' = g^\Delta e/e$, d_2 is the thickness of the head, and C is a coefficient with a value of 0.75. In another series of experiments, with saline density flows, it was found that C varies little with increase in slope of the bottom, up to a slope of 0.04.

The velocity (u) of the water near the bottom, at a distance x in front of the head, was found to be given by the equation

$$\log_{10}\left(\frac{u}{V}\right) = -0.93\left(\frac{x}{d_2}\right).$$

Two types of graded bed were formed, depending on the concentration of the suspension used. The "normal" type of graded bed, formed by surges with low sediment concentration, shows continuous grading within the bed at nearly all percentiles. The "coarse-tail" type of graded bed, formed by high-concentration surges, shows little grading through most of the bed, except for the coarsest 2-5 per cent of the size distribution. The differences between the two types of grading can be related to the depositional mechanics, which are revealed by slow-motion movies. In low-concentration flows, the bed is deposited layer by layer. In high-concentration flows, most of the bed is deposited first as an expanded or "quick" bed which continues to shear and to be disturbed by waves which form at the interface between the bed and the flow above. As the bed comes to rest, the waves disappear and the upper surface becomes perfectly flat.

A 300-foot color movie of the experiments will be shown.

MOORE, RAYMOND C., University of Kansas, Lawrence, Kansas

OBSCURE BUT IMPORTANT HIATUSES IN STRATIGRAPHIC COLUMNS

The thesis is advanced that virtually all stratigraphic columns exposed on land and penetrated in wells, including those of continental-shelf areas, contain hiatuses of varied nature, the aggregate geologic-time value of which may exceed that of the rock or unconsolidated sediment in the columns. Obscurity of the hiatuses—difficulty in recognizing them—is related mainly to objective features but certainly does not exclude subjective factors. Importance is judged by the amount of continuous time represented by the gaps and by their value in indicating causes for the hiatuses as well as their significance for determining basic principles that apply to time-stratigraphic classification.