closely interrelated with their lithology, structure, and fabric, and strongly reflect their alteration through diagenetic processes. Perhaps the most important of these processes, the compaction of clastics, causes progressive and unilateral reduction of pore space and expulsion of fluids. Compaction status—especially of shales—can be measured by interval velocities which increase irreversibly up to the maximum burial depth. In any specific basin, therefore, shale velocities indicate later uplift and thus aid in recalculating the thickness of eroded sediments. Shale velocities, when observed vertically and parallel with the bedding plane, exhibit an anisotropy which probably decreases with growing lateral tectonic stress. Rapidly deposited shales and shales embedded in evaporites, show retarded compaction and consequently delay in velocity increase. Psammites and carbonates have more complicated velocity patterns due to the complexity of their diagenesis. Evaporites show little compaction because of their primary lack of porosity.

All these phenomena are reflected in velocities and have been studied in basins where numerous well-velocity data were available (*e.g.*, NW German basin). Seismic velocity data, collected through advanced modern techniques, serve the same purpose. Although their accuracy is still comparatively limited, an almost quantitative interpretation may be reached with the aid of mathematical and statistical treatment of sedimentation models.

JONES, THOMAS A., Esso Production Research Co., Houston, TX 77001

Use of Ridge Regression Analysis in Geology

Multiple linear regression may be used to describe the relation of one geologic variable to several other (independent) variables, and may also be used to fit a trend surface to geographically distributed variables. The least-squares estimates of the regression coefficients commonly differ from the true coefficients if the independent variables are correlated. The estimates can be too large in absolute value, and may even have the wrong sign. Also, the least-squares solution may be unstable; replicate samples are likely to give widely differing values of the regression coefficients.

Ridge regression analysis, described by Hoerl and Kennard, is a technique for removing the effect of correlations from the regression analysis. The regression coefficients obtained are biased but have smaller sums of squared deviations between the coefficients and their estimates.

Correlations between geologic variables are common, and multiple regression coefficients based on these data may be suspect. For example, in trend surface analysis correlations between the geographic coordinates may range from zero (gridded data) to different from zero (clustered data) in a linear trend. In addition, when higher order terms are used in the trend the various powers of the geographic coordinates are highly correlated.

JORDAN, CLIFTON F., JR., Dept. Geol., Rice Univ., Houston, TX 77001

Bioclastic Sediment Dispersion off Bermudan Patch Reefs

Skeletal debris, shed from the top of patch reefs, forms a wedge of reef-flank sediment which angularly onlaps the reef mass at the uppermost reef flank and grades into lagoonal sediments in deeper water. Major avenues of sediment transport are reef-face channels, which connect sand channels of the reef top with upper sections of the reef flank. Maximum distance of sediment transport off the reef top is less than 100 m.

The understanding of compositional and textural trends across patch reefs is enhanced by use of a working model based on substrate type, biofacies development, particle breakdown, and sediment transport by wave action. Sediment composition provides the basis for recognition of the following microfacies: sediment pockets, sand channels, reef-face channels, reef flank, interreef lagoon, and open lagoon. These microfacies are transitional and, in the preceding order, display the following trends: from the reef top lagoonward, the abundance of *Homotrema*, coral, and red algae in the sediment decreases and the abundance of *Halimeda* and Foraminifera (excluding *Homotrema*) increases. Interreef lagoons are distinguished from open lagoons by a lower molluscan content in the sediment.

Because of the effects of irregular particle shapes and variable particle densities, textural trends are secondary in delineating patch reef facies. Sand-size particles dominate each facies from the reef top to the lagoon. The absence of silt and clay is characteristic of the reef top. Gravel is nearly evenly distributed, in part because of the large *Halimeda* content of the sediment (25–60%). Generally, mean grain size decreases from the reef top lagoonward, whereas sorting progresses from poor to very poor.

KELLY, THOMAS E., Dept. Natural Resources, State of Alaska, Juneau, AK 99801

Prudhoe Bay—Greatest Geologic Explosion of Our Time

Prudhoe Bay field, potentially the largest oil discovery on the North American continent, is on the flat-lying arctic coastal plain of Alaska.

The structure of the field resulted from 2 periods of deformation. The Lisburne and Sadlerochit (Carboniferous-Triassic) productive structure is a westward-plunging anticline superimposed on a stable ancestral shelf. The anticline broadens eastward until it is progressively truncated by a major unconformity. The geologic structure is complicated by 2 fault patterns cutting rocks of pre-Cretaceous age: (1) normal, NW-SE-trending faults on the south flank, and (2) high angle stair-step faults parallel with the axial plane of the fold on the north flank. The structure of the field, contoured with the top of the Kuparuk River (Cretaceous) as datum, is a pronounced eastward-plunging structural nose.

Two major depositional sequences have been recognized in northern Alaska: (1) an upper sequence composed of orogenic rocks with poor reservoir characteristics, and (2) a lower sequence ranging in age from Mississippian to Early Cretaceous which contains most of the Lisburne Group. Accumulation was controlled by structure and porosity-permeability variations. The middle and main producing zones are sandstones of Permian to Triassic age which compose a gigantic stratigraphic trap abruptly truncated and overlapped by impervious Cretaceous shales. The upper producing zones are confined to the western part of the field and consist of discontinuous lenticular sandstones of Late Jurassic and Early Cretaceous ages.

A model concept of field-wide unitization will be in effect before production commences in the mid-1970s.