

to kaolinite and books of authigenic kaolin are common in the subgraywacke and kaolinitic silty clay. Overgrowths of authigenic quartz are present and act as a cement in the orthoquartzite. Chert is rare in the orthoquartzite but is common in the subgraywacke.

The non-opaque heavy mineral suite consists of tourmaline, zircon, and rutile with a smaller amount of kyanite, staurolite, garnet, and euhedral biotite.

The Eocene sediments of the Texas Gulf Coast were derived from multiple sources and the Simsboro is no exception. Quartz types, chert varieties, K-feldspar, phyllitic rock fragments, and heavy minerals indicate that older sedimentary rocks, low-rank metamorphic rocks, granitic or gneissic rocks, and volcanic ejecta furnished detritus for the Simsboro.

KRUMBEIN, W. C., Northwestern University,
Evanston, Illinois

THE COMPUTER IN GEOLOGY: THE STATE OF THE ART

The past several years have seen a marked expansion in computer applications in geology. Universities, governmental agencies, the oil industry, and the mining industry all share in this activity. Although much work is still research-oriented, increasing effort is being made to extend computer facilities to exploration for oil, gas, and ore. Five aspects of computer utilization are woven through this activity; these are data acquisition, data storage and retrieval, data processing, presentation of results, and use of decision functions as an aid to interpretation.

Data acquisition is represented by new instrumental ways of obtaining data automatically, including remote sensing devices. Storage and retrieval are perhaps best known in the oil industry's activity in developing well-information systems, although much interest also centers on machine handling of scientific bibliographies. Data processing is the most active aspect of machine use, with new computer programs being developed for statistical processing of data, systems analysis, linear programming, and various applications of operations research. Spectacular developments in presentation of map data automatically, and in machine analysis of maps for trends (regionals and residuals), have occurred in the past few years. Development of decision functions (related closely to operations research) is evident, though perhaps less publicized than other aspects of computer utilization.

A major problem in this rapid expansion of computer use is the development of channels for publishing or exchanging computer programs. A center for earth science programs, tentatively called *GEOCOMP*, is being looked into. This center, whether located in a university, a research organization, or a governmental agency, could issue copies of programs, newsletters on current activities, and perhaps act as a training center for college teachers and geologists in industry. There is no doubt that computer activity in geology, which only a few years ago seemed still to be beyond the horizon, is now actively growing in our midst. Such rapid expansion calls for sound judgment in computer use, inasmuch as indiscriminate applications can produce very large mistakes very rapidly.

LAMING, D. J. C., Department of Geology, University of New Brunswick, Fredericton, New Brunswick, Canada

SEDIMENTARY STRUCTURES AND PALEOCURRENTS IN THE LOWER NEW RED SANDSTONE, DEVONSHIRE, ENGLAND

Permo-Triassic redbeds, consisting of mainly breccias and sandstones exceeding 6,000 feet in thickness, are well exposed in coastal cliffs in South Devonshire. They are disposed in semi-circular or elongate basins or cuvettes, margined by ridges of metamorphic rocks which supplied the bulk of the detritus.

The breccias show typical torrential bedding features. Low-angle cross-bedding units, festooned perpendicular to the direction of derivation, are interwoven with generally flat but lenticular beds of breccia and sandstone. Shallow channeling is common, deeper where sandstone is predominant. Mapping of pebble imbrication shows a basically centripetal transportation pattern in the cuvettes, consistent with derivations indicated by cross-bedding, channeling, and fragment composition. Roundness measurements of limestone fragments in the same rocks reveal sub-circular roundness contours increasing in value towards the cuvette centres, and approximately perpendicular to imbrication directions. All features indicate deposition on sub-montane alluvial fans in a semi-arid climate, with converging directions of sediment transport in semi-confined cuvettes.

Sandstones in the upper part of the sequence show clear eolian cross-bedding, with wedge-shaped units and some festoon cross-beds. Attitude measurement indicates deposition by a uni-directional wind from the SSW. Interbedded breccias show truncation and channeling of dune surfaces.

Quicksand injection structures occur in fine-grained silty breccias interbedded with sandstones (distal fan deposits). A saturated sand layer, sealed under an impermeable silty breccia, was mobilized and injected upward through desiccation cracks or other weak spots, forming sand dikes with elongate particles aligned parallel with the walls. Sun-cracked silt layers may show strongly upturned edges on desiccation polygons due to injection (extrusion) of quicksand, which may also be fragmented and dislocated.

Annelid burrows occur in some basal breccias, mostly fine-grained. Where elongate fragments constitute the breccia, the burrow filling shows a distinct internal fabric or "meniscus" particle arrangement. Commonly up to one inch in diameter with circular cross section, in coarser breccias they are ovoid and up to 7 inches wide. These large burrows branch, ascend through strata, and avoid large fragments; together with the consistent meniscus fabric, these features indicate organic origin.

LORANGER, D. M., Imperial Oil Ltd., Calgary, Alberta, Canada

DEVONIAN PALEOECOLOGY OF NORTHEASTERN ALBERTA

Shallow, epicontinental seas of Middle and Upper Devonian time in Alberta contained abundant microfauna and megafauna which can be used to interpret the environment at the time of deposition. Enough variation exists to differentiate supralittoral, littoral, sublittoral, arid lagoonal, humid lagoonal, and epineritic environments. A series of paleoecological maps for the Middle and Upper Devonian in northeastern Alberta illustrates the detailed paleogeographic history. The transitional boundary between the Givetian and Frasnian stages is explored and a contact postulated that is considerably higher stratigraphically than previously indicated. This paleoecological approach should be equally applicable to similar problems in any area and for almost any geological period.

LUCIA, F. J., WEYL, P. K., and DEFFEYES, K. S., Shell Development Company (A Division of Shell Oil Company), Exploration and Production Research Division, Houston, Texas