TV borehole cameras have many geological and engineering applications. In dry uncased holes, uses include determination of lithologic character and stratigraphic contacts, measurement of bedding and fracture orientation, identification of textural features (porosities), and establishment of causes of drilling problems including recognition of caved zones and intervals of circulation loss. A TV camera survey supplements or replaces coring. If hole walls are clean, inspection of the entire interval provides direct information normally lost where core recovery is poor. In holes containing buckled or perforated casing, lost tools or unknown obstructions, a TV traverse may guide the driller to an effective, time- and cost-saving remedy.

The Lawrence Radiation Laboratory has built two cameras for use in pre- and post-shot studies associated with underground nuclear explosions. These 2½-inch-diameter cameras can reach 3,000-foot depths and will operate in vertical or inclined holes up to diameters limited only by illumination capability. Both cameras have remote-control focussing. One camera, having a fixed side-viewing mirror, is equipped with a specially designed compass. The other camera looks down the axis of the hole. Field experience with these cameras is described and photos of the monitor image illustrate the results obtainable during in-hole operation. TV pictures showing the Gnome explosion cavity are compared with actual photographs taken inside this void.

The current status of TV borehole camera technology and possible future developments in both instrumentation and applications are reviewed.

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DEVELOPMENT OF THE COMMAP SYSTEM

COMMAP is an automatic mapping system. It uses an automatic map reader for digitizing the input data, an IBM 704 computer for processing the data and a Benson Lehner Electroplotter for plotting and contouring the output. This system processes, plots, and contours all mappable data. Computations which can be preformed by the system include the following: (1) determination of regionals and residuals by polynomial surface-fitting techniques, (2) determination of regionals and residuals by various ring-average methods, (3) upward and downward continuation of potential field data, (4) first and second vertical derivatives by several methods.

This paper covers the system in general and gives examples of tabulated, plotted and contoured output of the results for a number of specific field problems.

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VERTICAL PETROGRAPHIC VARIABILITY IN ANNOT SANDSTONE TURBIDITES

A wide range of mineralogical and textural variations was observed between the base and the top of marine Tertiary Annot Sandstone turbidites in the Lac d'Allos region of the French Maritime Alps. This variability may be related to the characteristic vertical distribution of grain sizes and shapes within such graded deposits. Relative percentages of most light and heavy minerals and of the primary matrix, as well as factors of sphericity and roundness, are directly related to grain size. Thus the upward decrease in grain size and increase in grain sorting is reflected in a progressive change in rock composition. Samples (43) were collected at 4-cm intervals between the base and top of four well graded turbidites, each less than one meter thick, and these were compared with spot samples (125) collected from a 250-m flysch section. The range of petrographic variability within a single turbidite is as great as the range of mineralogic and textural variations between the base and the top of the formation. The same minerals are found in each turbidite, indicating that source areas and eroded parent rock materials accumulated nearshore remained the same during the period of this formation's history. However, notable variations between succeeding turbidites were noted. This may be explained by the fact that each turbidity current is characterized by its own specific density and velocity gradient. As a result, differing proportions of particle sizes settled out of each suspension flow over the same spot on the ocean floor. Even though gravity currents are able to transport identical sedimentary materials from nearshore environments into the deeper basin, such quantitative variations should be expected in any formation composed of turbidites.

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ELECTRON MICROSCOPE STUDY OF ARAGONITE CRYSTALS IN MARINE SEDIMENTS

The occurrence of aragonite needles in the carbonate mud of the surface sediments of Florida Bay, the Florida Keys, and the Great Bahama Bank is of interest to problems of carbonate deposition. Older views regarding the origin of the aragonite needles support inorganic precipitation. More recent theories favor a biogenic formation and link the mud particles to the aragonite sheath of algae, mainly *Penicillus*, *Rhipocephalus*, and *Halimeda*. Electron microscope studies of mud suspensions and of aragonite crystals from *Penicillus* reveal a remarkable similarity between the aragonite formed on the algal surface, and the aragonite in the carbonate mud. Surface replicas of aragonite sheath peeled from *Penicillus* show needle-like crystals scattered between a network of fiber- or film-like algal material. The closely interwoven system of plant material and aragonite needles supports the suggestion of the algal substrate acting as a matrix for the aragonite formation.

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LATE MISSISSIPPIAN RHYTHMIC SEDIMENTS OF THE MISSISSIPPI VALLEY*

Late Valmeyeran and Chesterian sediments that repeatedly filled the subsiding Illinois basin are a quarter autochthonous carbonate, a quarter sand, and half mud brought from remote northeastern sources by a major river system, the Michigan River. These are arranged in cycles implying shoreline fluctuation landward (northeastward) and seaward through a range of a few hundred miles. About 70 minor reversals in shoreline movement are superimposed on about 15 major cycles. Increases in competence, perhaps in phase with modest lowering of sea-level, repeatedly changed the Michigan River into a prograding stream, pushing its delta scores of miles across a marine basin only a few tens of feet deep. Advancing distributaries carved grooves well below sea-level through frontal and lateral mud banks—grooves later filled by elongate sand bodies analogous with modern barfingers and pass fillings. In late stages the delta supported land vegetation. The carbonate phase

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