but to date sufficient evidence is unavailable for determination of the controlling factor.

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CALIFORNIA EARTHQUAKES—PICTORIAL REVIEW

Selected photographs show damage in three historic earthquakes: San Francisco, 1906; Santa Barbara, 1925; Imperial Valley, 1940. Relative value of building materials and techniques in resisting large earthquakes are evident from the pictures.

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MACHINE DIGITIZING AND PROCESSING OF GEOLOGICAL DATA OBTAINED FROM WELL LOGS

Integration of electronic machines for the efficient recording, computing, and plotting of exploration data has reduced the time, cost, and number of errors inherent in the manipulation of data.

The data processing system discussed encompasses all the phases of data recording, computing, and plotting. However, data recording still limits the machine approach because most manual methods are too slow and prone to error.

Jersey Production Research Company has developed and put into operation a digitizer, which is a desk-sized instrument designed to transfer basic stratigraphic data and their respective depths from well log overlays to punch cards. This unit has been incorporated into the machine system for processing geological data. The use of the digitizer reduces by one-half the time necessary for data tabulation, and increases the accuracy and efficiency of machine processing. The digitizer allows for the preservation of vertical positions (depths) for a maximum of 40 variables on one overlay. These variables, including lithologic features, oil shows, and (or) fluid contents, porosity ranges, and formation tops, are computed and plotted prior to the preparation of stratigraphic maps.

A specially designed computer program provides the necessary link between the digitizer and the IBM 650; it processes the data and computes thicknesses, subsea depths, ratios, and percentages in a form suitable for machine plotting of exploration maps. For subsequent studies involving correlation changes, the basic geological data, which are stored on cards, can be retrieved and reworked without retabulation.

The final step in the machine system is cross-sectioning, plotting, and contouring the computed data for visual presentation.

Savings in time and cost can not be estimated accurately, but they are more than sufficient to make geological data processing practical. The chief benefit of machine processing of exploration data is that it provides the geologist with data quality and several courses of investigation previously considered infeasible.

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DEVONIAN CALCAREOUS FORAMINIFERA FROM ARROW CANYON RANGE, CLARK COUNTY, NEV.

Calcareous foraminifera determined from thin-section studies of samples from a sequence of Devonian limestones in the Arrow Canyon Range of southern Nevada are assigned to three genera. These are: *Eonodosaria* Lipina, well represented from 575 feet to 765 feet below the top of the system; *Tikhinella* Bykova, found sporadically between 575 feet and 805 feet; a third, possibly new, genus, sparsely represented from 430 feet to 805 feet.

Representatives of these genera compare favorably with forms confined to limestones of late Frasnian age (Devonian) in the Russian platform, western Russia. The eonodosarians, in addition, are similar to forms of probable late Frasnian age from Kwang-si Province, south-central China.

On the basis of the similarity of the Nevada fossils to those from Russia and China, a late Frasnian age is suggested for a part of the Devonian limestone sequence in the Arrow Canyon Range.

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BIOSTRATIGRAPHY OF LOWER PERMIAN HUECO GROUP, HUECO MOUNTAINS, TEXAS

On the geologic map of the Hueco Mountains, Texas King *et al.* (1945) recognized three "divisions" of the Hueco Limestone: a lower light gray limestone, 500 feet thick (including a Powwow Member); a middle dark gray limestone, about 250 feet thick; and an upper light gray limestone, 800 feet thick including 180 feet of redbeds (Deer Mountain Red Shale Member). The term "division" has no standing in the stratigraphic code; yet the divisions of King can not simply revert to member status; members may not contain members. Furthermore they can be and have been mapped throughout the range; each is lithologically distinctive and amazingly uniform. Therefore, it is proposed that the lower, middle, and upper divisions be elevated to formation rank, and the Powwow and Deer Mountain units be retained as members. Accordingly the Hueco Limestone is renamed the Hueco Group.

The formations of the Hueco Group contain distinctly different assemblages of fusulinid species. The lower, the middle, and most of the upper formation are within the "zone of Pseudoschwagerina" (Wolfcampian Series). The Wolfcamp-Leonard boundary, marked by the appearance of a *Schwagerina crassitectoria-S. franklinensis* fauna, falls within the upper formation about 80 feet above the last appearance of *Pseudoschwagerina*. The composition of the fusulinid faunas of the Hueco Group is as follows (in ascending order): Powwow Member—*Pseudoschwagerina beedei, Schwagerina bellula, S. huecoensis, Triticites powwowensis;* lower formation—*Monodiexodina linearis, Pseudoschwagerina beedei, P. texana, P. uddeni, Schwagerina bellula, S. emaciata, S. huecoensis,* and *S. knighti;* middle formation—*Schwagerina eolata, S. neolata;* upper formation—*Pseudoschwagerina convexa, P. gerontica, P. texana, P. uddeni, Schwagerina diversiformis,* and *S. nelsoni; Schwagerina crassitectoria* and *S. franklinensis.* No fusulinids were found in the Deer Mountain Member. Facies control of fauna is strikingly demonstrated in the occurrence of a typical Wolfcampian assemblage in the lower formation, its replacement by the specialized *Schwagerina eolata-S. neolata* assemblage in the middle formation, and its reappearance in the upper formation.

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PALYNOLOGY AND DETERMINATION OF ANCIENT ENVIRONMENTS

Determination of ancient environments by the palynological approach utilizes principles derived from