

teria to stabilize vast layers of metal sulfides, the feasibility of which has been experimentally demonstrated by Baas Becking.

(c) *Epidiagenesis* (writer's term) is the "meteoric phase," during which tectonic emergence of the basin occurs. The ascending waters (of high pH) are replaced by or mixed with descending CO_2^- and oxygen-rich waters of meteoric origin (pH7, or even less when they drain from some lakes and streams). Pyrites commonly are oxidized, and the liberated iron forms Liesegang diffusion rings throughout porous rocks like sandstone, or along the joint planes of impervious types. Limestone develops karst features. Calclitic fossils that escaped syndiagenetic destruction may now be reduced to hollow casts.

Continental-shelf sediments under eustatic oscillations may pass through several epidiagenetic interludes before anadiagenesis, this leading to early lithification of carbonate layers. In a thick rock sequence containing several unconformities, multiple incidences of anadiagenesis and epidiagenesis are expected.

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APPLIED CARBONATE PETROLEUM GEOLOGY SYMPOSIUM: INTRODUCTION

The 1966 A.A.P.G. Research Symposium is entitled "Applied Carbonate Petroleum Geology." It consists of papers that deal with salient aspects of carbonate-rock analysis methods which can be applied clearly and readily to petroleum exploration and development. The main purpose of this symposium is to reduce much of the highly specialized, advanced work that has been accomplished over the past decade, in both methods of analysis and interpretation, into essentials meaningful to the geologist engaged in day-to-day activities of petroleum exploration and development. This includes such subjects as: petrophysics, paleoecology, petrography, geochemistry, geostatistics, simulation of depositional processes, carbonate-rock nomenclature, paleogeologic and lithofacies analyses, and area case histories.

Throughout the symposium the central theme is methods of analysis and resulting geological interpretations. Wherever possible, the occurrence of petroleum is correlated with the geological aspects discussed.

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ASTRONAUT TRAINING PROGRAM IN GEOLOGY AND GEOPHYSICS

The geologic training program for the first 29 astronauts began in February, 1964, and has consisted of four phases. The first phase emphasized training in the principles of geology, geophysics, mineralogy, and petrology. Phase II was designed to provide extensive experience in a wide spectrum of terrestrial geology having lunar application, with particular emphasis on volcanic and impact geology. Phase III emphasized training in carrying out terrestrial geologic mapping, geophysical studies, and sampling procedures. Phase IV is presently underway, and consists of terrestrial simulations of Apollo missions.

In all phases of the training program, field work has been heavily emphasized. The field trips have been to classic geologic localities and have been led by

recognized experts on each area. The first three phases of the training included 14 field trips totaling 41 days in the field, in addition to 135 hours of classroom instruction.

The operation of the training course has been a cooperative effort of the Astrogeology Branch of the U.S.G.S. and the Lunar Surface Technology Branch of the Manned Spacecraft Center of N.A.S.A.

A complete geology classroom has been set up at the Manned Spacecraft Center including most of the teaching aids and equipment available in the average modern geology department.

The astronauts have strong backgrounds in the physical sciences and have proved to be excellent students. With the intensive and specialized training that they have received, they will provide the scientific community with uniquely qualified representatives for early lunar exploration.

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FORAMINIFERAL PALEOECOLOGY OF UPPER MIOCENE MONTESANO FORMATION, WESTERN WASHINGTON

The Montesano Formation, which ranges in age from late Miocene to questionable early Pliocene, is exposed in an area of approximately 250 square miles of Grays Harbor County in western Washington. It averages 2,500 feet in thickness and consists predominantly of fine- to medium-grained sandstone, with mudstone, pebbly sandstone, and conglomerate locally significant. The formation possibly represents the last marine incursion in a depositional basin that existed generally as a strongly negative feature through most of the Tertiary.

Paleoenvironmentally significant faunas from the Montesano Formation include: (1) rock-boring pelecypods, (2) *Chione-Spisula* molluscan assemblages, (3) a *Miliammina fusca* fauna, (4) a *Buliminella elegantissima* fauna, (5) a *Nonionella* fauna, (6) a *Bolivina* fauna, (7) a *Uvigerina peregrina hispidocostata* fauna, and (8) a *Bolivina seminuda* fauna. The succession of these assemblages, the associated quantitative microfaunal trends, and the sedimentary evidence indicate that the formation was deposited in a sea that first transgressed from west to east over Grays Harbor basin and then regressed. In the western part of the basin, water depths increased progressively from zero to more than 3,000 feet. On the east, deposition took place initially in the littoral zone, later the outer shelf, and finally under probable tidal sand-flat conditions. A local laminated mudstone unit contains an impoverished fauna suggestive of a partly closed basin about 2,000 feet deep with a sill at about 800 feet. Graded bedding, convolute structures, channels filled with shallow-water deposits, and a high percentage of displaced fauna indicate that much of the sediment was emplaced by turbidity currents and slumping. Planktonic Foraminifera indicate that late Miocene sea-surface temperatures in the Grays Harbor area were of the order of 10-15°C. A small terrestrial flora reflects a mild temperate climate.

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RELATIONS AMONG SHEAR STRENGTH, PHYSICAL, AND ACOUSTICAL PROPERTIES OF SEDIMENT CORES FROM EASTERN PACIFIC

A series of sediment cores ranging in length from