the three axes of the carinae by scanning electron and light microscopy. The septal structure of the two genera shows organization of fibrous calcite into septal trabeculae which form carinae and also into intercarinal tufts of elongate crystals. In some specimens the carinae are single monacanthine trabeculae; lateral expansion perpendicular to the plane of the septum forms the flanges. In other (fewer) specimens, the carinae are compound trabeculae with multiple calcification centers and branching trabecular axes. This has no apparent taxonomic or stratigraphic significance in Heliophyllum. Zigzag carinae, as seen in Cyathocylindrium, are formed by one laterally expanded trabecula for each zig or zag, but where carinae are closely spaced, they are formed of one trabecula continuous across the septum. In both genera, carinae are formed as prominences on the septal margin; intercarinal parts of septa were filled in around them.

Carinae of this type are characteristic of two families, the Zaphrentidae and Craspedophyllidae, that were characteristic of the Eastern Americas Realm during Early and Middle Devonian time.

pHD

NUMERICAL MODELING OF GEOTHERMAL SYSTEMS

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Numerical solutions to the equations describing the transport of heat and water in porous media are being used to study steady state conditions in areas of potential geothermal development. Using preliminary data on temperature distributions, geochemistry, and hydrology, various models for the natural conditions in these systems can be tested and additional data requirements can be evaluated.

A computer program has been developed to treat problems in 1, 2, or 3 dimensions involving simple or complex geometries. Model applications in the Long Valley, California, area include studies of heat transfer in an upflowing hot spring system and a recharging-discharging reservoir. Studies of natural (cellular) convection in porous media have also been made.

SYSTEMS ANALYSIS APPROACH TO PELAGIC SEDIMENTATION

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Applying the standard methods of systems analysis, river flow is considered the input to the system, the sediment reaching the ocean floor as the output and the system function is determined by the properties of the ocean. The simplest type of system functions are obtained by considering models of the ocean consisting of a surface ocean and a deep ocean which interact by vertical mixing and by the sinking of biologically produced particulate matter. Balancing the rate of increase of each chemical species in the surface and deep oceans yields a mathematical description of the system in terms of a coupled set of first order nonlinear differential equations. The generality of this set of equations allows for such processes as limitation of the biological production of particulate matter by the availability of nutrients and the effects of $CaCO_3$ compensation in the deep ocean. One of the obvious results of consideration of the

simplest models is that th
steady state. The model a
meaning of the response ti
species Si, Ca, C and P, r
It follows that the tempor
greater than 10^6 years, re
Deep Sea Drilling Project
in the river inputs.

STRUCTURAL AND PALEOMAGNETI
DEATH VALLEY, CALIFORNIA

Spall, Henry, U.S. Geolo
W. Troxel, Geological
Boulder, Colorado 8030

Upper Precambrian basic int
paleomagnetic and isotopic
paleomagnetism of diabase i
gated for two reasons: for
information on block tecton
province. Samples of diabas
southern Black Mountains, a
tization to 620°C and AF de
magnetic behavior were obse
magnetization, and after co
sent structural attitudes, t
verged about a common axis.
netization. This instabilit
effects and in part to secon
Basin and Range deformation.
from this preliminary study:
the age of the intrusions is
in this southern part of Dea
paleomagnetic methods.

DEFORMATION HISTORY OF CRETA
ISLANDS

Speed, R. C., Department
ersity, Evanston, Illinois

St. Croix is underlain by v
inferred Upper Cretaceous a
of the island exposes a sec
minor chert. Distal facies
mal facies, the upper. The
ted near the base of slope
rections are uncertain. Th
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chert. P_2 deformation const
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of P_1 and P_2 are colinear,
of a great (or near-great)
initially verged between W
plunging 50°N75E. P_3 axial
and NE and dip steeply. Elo