will minimize the movement of mine water into deep aquifers. The hydraulic conductivity of sand rich overburden will decrease upon being distrubed, thus lowering the transmissivity of reclaimed aquifers. Sand and shale isopach maps of the lignite overburden can be used to determine the spatial variation of hydraulic properties that could occur at a site that is mined and reclaimed. The location of and water pressure in aquifers at the mine site dictate the boundary conditions used in a numerical analysis procedure which predicts the groundwater flow conditions in and adjacent to a reclaimed mine. Numerical analyses indicate that the discharge of mine groundwater to streams and lakes at the mine site should be a major concern when mining in shale rich overburden while in sand rich overburden the major concern should be for contamination of aquifers beneath or adjacent to the mine.

HIGH RESOLUTION HOLOCENE PALEOCLIMATOLOGY AND STRATIGRAPHY, ORCA BASIN, GULF OF MEXICO

KENNETT, J. P. and PENROSE, N., Graduate School of Oceanography, University of Rhode Island, Kingston, R. I. 02881; LEVENTER, A., Department of Geology, University of South Carolina, Columbia,S.C.

High resolution stratigraphy, quantitative micropaleontology and stable isotopic analyses have been conducted on a suite of Holocene piston cores from the Orca Basin, northern Gulf of Mexico. This basin contains a 200 m thick brine layer which excludes benthonic life. Holocene cores examined have remained unbioturbated, organic rich, and laminated and exhibit sedimentation rates up to 1 cm per 10 years. The quality of preservation of both carbonate and siliceous microfossils seems to be unsurpassed for marine sediments. Thus we have been able to establish a Holocene paleoclimatic record of very high resolution compared with most previous studies.

Factor analysis of planktonic foraminiferal and pteropod assemblages reveal a distinct paleoceanographic and paleoclimatic cyclicity through the entire Holocene. Carbon 14 dates show the period of this cyclicity to be 2300 years which is almost identical to the 2400 period noted in tree-ring ^{14}C concentrations. The three older cycles ranging from 2300 years to 9500 years, as defined by oscillations in pteropod assemblages, are almost identical and resemble saw-tooth patterns. However, the pattern of the last cycle ranging over the last 2300 years is of different character. It is speculated that this cycle is different because of anthropogenic effects. Each cycle begins with a dramatic shift in less than 100 years. The planktonic faunal oscillations are matched by oxygen isotopic oscillations of up to 0.6 per mil. These are considered to reflect oscillations in surface waters in the northern Gulf of Mexico.

MAGNETOSTRATIGRAPHY OF CARIBBEAN DEEP-SEA SEDIMENTS AT SITE 502: A COMPLETE LATE MIOCENE TO RECENT HIGH RESOLUTION RECORD

KENT, Dennis V. and SPARIOSU, Dann J., Lamont-Doherty Geological Observatory, Palisades, N.Y. 10964

A total stratigraphic thickness of 220m was recovered in four adjacent holes with the hydraulic piston corer at DSDP Site 502 in the Caribbean. Paleomagnetic measurements were made at 10cm intervals on whole-core sections with a long-core spinner magnetometer onboard Challenger. The good core recovery, with overlapping sections and the undisturbed nature of the piston cored sediment allow us to construct an essentially complete record of Late Miocene to Recent geomagnetic polarity history. Correlation of the polarity zonation to the age-calibrated standard sequence of geomagnetic reversals provides about 23 datums in this section approximately 300 ky apart on average. This allows us to place the geological phenomena recorded in the sediment, including biostratigraphic events, climatically-induced sedimentary and isotope cycles, and paleo-oceanographic changes, in a precise geochronological framework. Sedimentation rates in general decrease up-section, from about 35 m/m.y. in the Gilbert, 33 m/m.y. in the Gauss, 28 m/m.y. in the Matuyama to 25 m/m.y. in the Brunhes. The high resolution of this record permits us also to identify and date several finer scale features of geomagnetic field behavior such as short-period excursions, and potentially to study details of polarity transition zones.

EROSIONAL MORPHOLOGY OF THE BLAKE ESCARPMENT , CONTINENTAL MARGIN EAST OF FLORIDA

KENT, Kathleen M. and DILLON, William P., U. S. Geological Survey Woods Hole, MA 02543; ROBERTS, David G., Institute of Oceanographic Sciences, Wormley Godalming, Surrey, England; PAULL, Charles K., U. S. Geological Survey, Woods Hole, MA 02543

A side scan sonar survey, using the GLORIA (Geologic Long Range Inclined Asdic) system, used along 430 km of the Blake Escarpment, has provided the first observation of its morphology and new data on its origin. The escarpment is an extremely steep (about 40°), 4-km-high submarine cliff that forms the boundary between continental margin and ocean basin east of Florida. Because the slope is so steep, ordinary vertical-incidence wide-beam profiling cannot show the true surface; it portrays the slope as a group of diffractions. Using the GLORIA system (22-km maximum range to each side), we obtained two views of the escarpment, one looking upslope from the Blake Bahama Basin and a second looking downslope from the top edge of the escarpment. The data are interpreted in conjunction with vertical-incidence seismic-reflection data.

The sonographs show the steep slope of the escarpment and indicate that it is broken into a series of steplike steep slopes and terraces that we interpret as the result of differential erosion and associated collapse of subhorizontal strata. The escarpment south of the Blake Spur is almost perfectly straight and oriented in a northerly direction. Linear features at the base of the escarpment in the Blake Bahama Basin are interpreted as scour channels parallel to the escarpment and sediment waves transverse to the escarpment. The scour marks, sediment waves, and rough stepped face of the escarpment imply erosion by strong currents and indicate that erosion is the primary factor in shaping the escarpment's morphology.

IDENTIFICATION OF A PALEOCHANNEL SYSTEM UNDER THE EASTERN FLANK OF CHESAPEAKE BAY

KERHIN, Randall T., HALKA, Jeffrey P., & CONKWRIGHT, Robert D. Maryland Geological Survey, 2100 Guilford Avenue, Baltimore, Maryland 21218

High-resolution subbottom profiles in the mid-Chesapeake Bay region have delineated a major paleochannel system along the eastern flank of the present-day Bay. The course of the paleochannel has been traced from the mouth of Eastern Bay, under the Poplar Island group and into the Dorchester County landmass (Poplar Island Channel), appearing again beneath the present head of Tangier Sound (Tangier Sound Channel). With in the sound a distributary system of paleochannels is evident with the deepest channel on the east flank of Tangier Sound and shallower channels passing under the wetland areas of South Marsh and Smith Islands. Multiple refectors in portions of the Poplar Island and Tangier Sound paleochannels reveal a basal deposit conforming to the channel configuration overlain by cross-bedded channel fill. Thalweg depths average approximately 40 to 45 meters below present sea level. Sediment cross-bedding indicates the channel was infilled from a northeasterly direction.

Stratigraphic relationships indicate that this channel system is older than the deposits of the Kent Island Formation (Owens and Denny, 1979) of mid to late Sangomon. The paleochannels were incised in the Tertiary sediments during the Illinoian (?) regression and are the southern extension of the Chester River Channel (Schubel, 1973). The channels did not cut across the DelMarVa peninsula in this area as has been postulated and probably continued to the south roughly parallel to the present axis of the Bay.

MAGNETOSTRATIGRAPHY OF THE SIWALIK SEDIMENTS IN BHITTANI-MANWAT ANTICLINE, TRANS-INDUS SALT RANGE, PAKISTAN

KHAN, M. Javed and OPDYKE, Neil D., Lamont-Doherty Geological Observatory, Palisades, N. Y. 10964

In order to establish the chronostratigraphic horizons in rocks of the Siwalik Group, exposed in the Trans-Indus Salt Range, Pakistan, two sections were measured and sampled from Bhittani-Manwat anticline. One section is more than 2200 meters thick and exposed along Bain Pass. The second section is about 1000 meters thick and exposed along Pezu Pass. NRM of each sample was measured and the direction of stable component of magnetization was obtained after partial a.f. and thermal demagnetization. VGPs were calculated and a sequence of magnetic polarity reversals was obtained. Considering Plio-Pleistocene age for rocks of these two sections, based on Pinjor fauna, magnetic polarity reversal sequence obtained was correlated with the standard magnetic polarity time scale. Bain Pass section ranges in age from Lower Brunhes to Lower Gauss chron, while Pezu Pass section ranges in age from upper Matuyama chron to Olduvai subchron. Sedimentation rate calculated for Lower Matuyama time in Bain Pass section is 0.95m/1000 years and suggests that the Reunion subchron lasted for 25000 years. Sedimentation rate calculated for Pezu Pass section is 0.77m/1000 years. These sedimentation rates are higher than those of Siwalik sediments of similar age in the Eastern Salt Range and suggest rapid subsidence of the basin of deposition. These sediments demonstrate tectonic activity in this region as late as 700,000 years B.P., since rocks of Lower Brunhes age are deformed.

EAST PACIFIC RISE--TAMAYO TRANSFORM FAULT INTERSECTION

TAMAYO SCIENTIFIC TEAM (presented by W.S.F. Kidd and D.G. Gallo), Department of Geological Sciences, State University of New York at Albany, Albany, NY 12222

A 7-dive manned submersible (DSRV ALVIN) program has examined the easternmost 8 km of the Tamayo Transform Fault at its intersection with the East Pacific Rise (EPR). The general trend of the transform and the northern boundary of the R-T intersection is defined by the 300-600 meter high North Wall. Within the immediate vicinity of the ridge-transform intersection, the North Wall is occupied by numerous small vertical offset (<5 m) faults that dip steeply (60°-90°) toward the transform domain. The width of this active zone of faulting is about 1.5 km and borders the fresh volcanics (pillow lavas, ponded flows) of the EPR inner valley. As the transform is approached along the rise axis these volcanics are dissected by fissures and small throw (<10 m) faults whose dominant trends gradually change from ridge axis parallel to nearer transform-parallel. West of the ridge axis intersection the width of the active transform is confined to a 100 m wide zone at the base of the North Wall. The North Wall in this area is a tectonically inactive sedimented slope with abundant loose, isolated blocks (typically 10-50 cm) of mostly sedimentary rocks and some basalt lying on it. The transform zone is bounded to the south

by inactive rift generated structures with trends oblique to both ridge and transform. Evidence of low level hydrothermal activity was found on the rift valley floor and 7 km west of the ridge axis along the transform fault. No evidence was found to suggest the widespread development of secondary shear structures along the active transform; the systematic change in orientation of rift valley faults can be explained by a changing stress field orientation within about 5 km of the transform intersection.

CONCEPTUAL MODEL OF SHELL BED FORMATION: MECHANISMS, TIME SCALES, AND PALEOBIOLOGIC SIGNIFICANCE

KIDWELL, Susan M., Department of Geology and Geophysics, Yale University, New Haven, Connecticut 06520

A detailed survey of shell accumulations in the Miocene Chesapeake Group, Atlantic Coastal Plain, provides an empirical basis for a new model of shell bed formation, recognizing both biologic and sedimentary mechanisms. Although a low rate of net sedimentation is the basic sedimentary mechanism of shell concentration (by failing to dilute biologic shell input), it is the change in sedimentation rate that determines the physical and paleontologic nature of the shell bed. This change may be inferred from the nature of bed contacts, which may be used as an objective criterion for the genetic classification of shell bed types. Shell input rate is here assumed to be constant.

Type I. Decrease in net sedimentation rate from + to 0 generates shell bed with gradational lower contact and sharp upper omission surface.

Type II. Increase in net sedimentation rate from 0 to + produces shell bed with sharp basal omission surface and gradational upper contact.

Type III. Decrease in net sedimentation rate from 0 to - generates shell bed with sharp basal omission surface and sharp upper erosional surface.

Type IV. Increase in net sedimentation rate from - to 0 produces shell bed with sharp basal erosional surface and sharp upper omission surface.

These four sedimentary mechanisms of shell concentration operate on all time scales, from the geologically instantaneous ecologic scale (10^0-10^2 yr; storm events; diastemic accumulations) to subevolutionary and evolutionary scales (10^3-10^4yr; 10^5-10^6yr for mollusks; complex shell beds associated with unconformities). Longer-scale accumulations comprise many shorter-scale sedimentary and biogenic accumulations. Classification by this model has predictive value in estimating postmortem bias of individual fossil assemblages and of "temporal" paleobiologic patterns such as mode of speciation and community evolution.

THERMAL INFRARED OBSERVATIONS OF MT. ST. HELENS: MARCH-MAY 1980

KIEFFER, Hugh H., U. S. Geological Survey, Flagstaff, AZ 86001, and FRANK, David, U. S. Geological Survey, Seattle, WA 78105

Airborne infrared observations began two days after the first Mt. St. Helens eruption. The objectives of these observations were both for hazards prediction, in terms of identifying locations of enhanced heat flow, possibly preceding a flank eruption or debris flow, and to quantitatively measure the thermal changes associated with the sequence of eruptive events.

Observations included: film recorded uncalibrated scanners, high spatial resolution video recorded systems, handheld (in helicopter) imaging system and radiometer, and calibrated digital scanners. The first observation (March 30) showed likely internal heating in the summit crater, locally along the normal fault trending E-W through the summit, in two large fractures on the upper north slope, as well as at two locations of minor pre-eruption heat flow. Although there were several visual reports of "hot spots" (based largely on behavior of new fallen snow), no areas of internal heat flow were found away from the summit.

During an early eruption, a majority of blocks seen to be thrown out hot were found to cool within a few minutes; these were apparently debris blocks heated surficially by steam condensation in the few seconds of upward trajectory, rather than material from a heated interior region.

In the area of the "bulge", infrared anomalies increased in abundance from early April until just prior to May 18 eruption, when the upper part of the bulge appeared perforated with heat leaks. Observations after May 18 have been severely hampered by bad weather. Infrared anomalies found outside of the new crater are all thought to be deposits of pyroclastic material; no locations of internal heat flow have been found outside the crater.

COMPARISON OF THE THERMODYNAMICS OF EXPANSION OF H_2O, CO_2, SO_2, and S END-MEMBER PHASES DURING VOLCANIC ERUPTIONS ON THE EARTH AND ON THE JOVIAN SATELLITE, IO

KIEFFER, Susan Werner, U.S. Geological Survey, Flagstaff, Arizona, 86001

H_2O and CO_2 are the driving volatile phases in terrestrial volcanism; S and SO_2 have been proposed as the driving volatiles in the active volcanoes on Io. In order to compare volcanic behavior on the two planets, it is necessary to be able to calculate the effects of (1) differing geotherms or Iotherms on the driving volatile phase; (2) the thermodynamic path of ascent; (3) the phase relations of the driving fluid; (4) the ambient surface pressure, temperature and gravity of the planet (which are very different on the earth and on Io); and (5) the vent geometry. A simplified model for the dynamics of volcanism which accounts for all of these effects has been developed. The dynamics are accounted for using fluid flow equations for a diverging vent geometry. Because the rapid expansion of end-member volatile phases is a quasi-isentropic process (Kieffer and Delany, JGR, 84, 1611, 1979) the thermodynamic paths of ascent are usefully represented on temperature-entropy phase diagrams, which will be presented for the four end-member phases mentioned above. Under volcanic reservoir conditions on the earth, H_2O and CO_2 will give rise to qualitatively different eruption styles, owing to their different thermodynamic properties and phase diagrams: during ascent from a reservoir to eruption at the surface, H_2O can undergo either a liquid-vapor (boiling) or a vapor-liquid (condensation) transition, depending on the initial conditions, whereas CO_2 should erupt to the surface from all depths as a vapor alone. Plausible Iothermal gradients suggest that the smaller plumes observed, and geysers and fumeroles below the limits of resolution, could be produced by boiling from an SO_2 reservoir, but that in the largest plumes SO_2 is condensing from a vapor to liquid and solid phases respectively.

THE MAY 18 LATERAL "BLAST" AT MT. ST. HELENS: PRELIMINARY MAPPING OF EFFECTS IN THE DEVASTATED AREA AND A MODEL FOR MULTIPHASE FLUID FLOW

KIEFFER, Susan Werner, U.S. Geological Survey, Flagstaff, Arizona 86001

In March 1980, phreatic eruptions from the summit of Mt. St. Helens provided evidence that a hydrothermal system had developed within the volcanic edifice; on May 18, the upper part of the north slope of the mountain failed suddenly and thereby reduced the confining pressure on the hydrothermal system. The material in the hydrothermal system (old, dense volcanic rocks; a characteristic, presumably young, scoriaceous gray pumice; steam) flowed laterally through the new vent into a wide sector north of the mountain. This flow, referred to by field workers as "the blast", devastated forests through a sector of 150°, extending more than 16 km to the NE and 27 km to the NW. Preliminary mapping of the direction of fall of the trees shows two major, irregularly shaped zones: (1) an inner zone, termed the "direct blast zone", in which the flow was approximately radial from the volcano and was relatively undeflected even by large topographic features, and (2) an outer zone, termed the "channelized blast zone", in which the flow followed or was deflected by the local topography. Streamlines of flow thus are not simple radii from the source, a fact that should be considered in studies of the "blast" deposit or devastated area. Tree damage and characteristics of the "blast" deposit were documented at 20 sites along 4 streamlines to provide data on size, abundance and density of particles, and on dynamic pressure and flow velocity for a thermodynamic and fluid-flow model of the blast. The flow appears to have been a dense, multiphase "wind" composed of steam, rock fragments and entrained organic debris which expanded laterally from the hydrothermal system. The model considers the volumetric expansion of a mass with an initial kinetic energy of the order of 10^8 ergs/g into a sector of 150° north of the volcano with continual changes in potential energy owing to the terrain ($\Delta PE = 5 \times 10^7$ ergs/g for a 500-m height change). In the "direct blast zone" the kinetic energy was larger than potential energy changes on uphill runs; in the "channelized blast zone" potential energy changes were comparable to or dominated the kinetic energy of the flow. Velocity of the flow, temperature of the wind, and dynamic pressure exerted on the trees are calculable as a function of distance and the model should allow hazard zones to be estimated for future events of this type.

OXYGEN AND CARBON ISOTOPES OF INDIVIDUAL SHELLS OF PLANKTONIC FORAMINIFERA FROM THE ONTONG-JAVA PLATEAU

KILLINGLEY, John S., JOHNSON, Richard F. and BERGER, Wolfgang H., Scripps Institution of Oceanography, La Jolla, California 92093

Single shell analysis of planktonic foraminifera has one particular advantage in stratigraphy: it can provide an instantaneous sampling of ocean conditions which is not possible when a sample of two or more shells is used. Short-lived anomalous conditions in ocean history should appear as distinct modes in the distribution of isotopic values at a given stratigraphic level.

Analyses of single shells of Orbulina universa show ranges of 2 $^o/_{oo}$ in $\delta^{18}O$ and $\delta^{13}C$ at various levels in a box core from the western equatorial Pacific. Seasonal and interannual variations can account for only about half of this range; variations in depths of calcification and in metabolic effects must account for the rest.

The large range must introduce considerable noise in multi-shell analysis unless the number of shells in the sample is of the order of 50 or more.

We did not find a change in the range down core; nor did we find any evidence for the deglacial "meltwater spike."

SEISMIC STRATIGRAPHY OF THE MAGDALENA FAN AREA, COLOMBIA BASIN

KIM, Hae-youn and BUFFLER, Richard T., University of Texas Marine Science Institute, 700 The Strand, Galveston, TX 77550

Two regional north-south multichannel seismic lines across the Magdalena Fan and the eastern Colombia Basin show a thick sedimentary wedge overlying acoustic basement. Thicknesses of the entire section range from 6 km along the lower slope to 2 km in the northern Colombia Basin.

The section is divided into 5 major seismic stratigraphic units bounded by major unconformities. Acoustic basement can be correlated with Horizon B" identified in DSDP hole 153 in the Aruba Gap area 400 km to the east. Successive unit boundaries are tentatively correlated with Cretaceous-Tertiary, Oligocene-Miocene, Middle Miocene, and Late Miocene-Pliocene ages respectively.

The lowest unit of rift sediments fill an irregular faulted basement and are themselves affected by the faulting. The middle 3 units (generally parallel, continuous reflectors) onlap a regional basement high in the northern Colombia Basin. These units represent a long period of uniform, hemipelagic mud and distal turbidite deposition.

TUESDAY, NOVEMBER 18, 1980

POSTER SESSION 5
GWCC, Level II
Authors will be present from 0900 to 1100 hours

Structure

Philip Berger, Arvid M. Johnson:* First-Order Analysis of Deformation of a Thrust Sheet Moving over a Ramp ..... Booth 24
Edwin H. Price:* Mesoscopic Shear Zone Evolution in Multilayered Basalt Folded at Shallow Depth .... Booth 25
Steven Wojtal:* Deformation within Thrust Sheets ... Booth 26
Richard E. Williams:* Creation and Geometry of the Thrust Fracture Surface ..... Booth 27
John C. Lorenz:* Lithospheric Flexure and the History of the Sweetgrass Arch, Northwestern Montana ..... Booth 28
Rick E. Chamberlain, John Lemish:* Basement Control of Structure within the Forest City Basin of Iowa ..... Booth 29
S. Bhattacharji:* Faults and Rift Patterns in and around Magmatic Centers and Their Potential for Hydrothermal Ore Deposits and Geothermal Energy ..... Booth 30

Tectonics

Daniel A. Sundeen, Deborah S. Baker:* Petrologic Data in Support of a Mesozoic Continental Rift Process in the Structural Evolution of the Mississippi Embayment ..... Booth 42
Robert D. Bentley:* Wrench Tectonic Model for the Late Cenozoic Evolution of Oregon and Washington ..... Booth 43
Steven Schamel:* Tectonic Evolution of the Tunisian Atlas ..... Booth 44
J. N. Alt, R. E. Harpster, D. P. Schwartz:* Late Quaternary Deformation and Differential Uplift along the Pacific Coast of Costa Rica ..... Booth 45
Roy K. Dokka, R. H. Merriam:* Basin and Range Extension in Northeastern Baja California, Mexico . Booth 46
John F. Lewis, Grenville Draper:* Continued Evolution of a Subduction Complex by Transcurrent Tectonics: Cenozoic Development of the Far Arc Region of Northern Hispaniola ..... Booth 47
Joseph A. Caggiano, Karl R. Fecht, Susan M. Price, Stephen P. Reidel, Ann M. Tallman:* A Preliminary Assessment of the Relative Rate of Deformation in the Pasco Basin, South-Central Washington . Booth 48
P. A. Mueller, R. Erskine, D. L. Smith:* Possible Tectonic Implications of Volcanism in Northwestern Mexico ..... Booth 49
William A. Thomas:* Evolution of Embayments and Promontories of the Continental Margin ..... Booth 50
Douglas L. Smith:* Relationship of the Florida Basement to the Opening of the North Atlantic ..... Booth 51
Stephen Paul Phipps:* Confirmation of Imbricate Thrusting in the California Coast Ranges: Geology of the Mysterious Valley Area, Napa County ..... Booth 52
W.S.F. Kidd, D. G. Gallo:* East Pacific Rise—Tamayo Transform Fault Intersection ..... Booth 53
Kenneth R. Walker, Ganapathy Shanmugam, Stephen C. Ruppel:* The Interplay of Tectonic/Loading Subsidence, Terrigenous Sediment Deposition Rate, and Carbonate Buildup Rate in the Development of Shelf to Basin Facies Patterns ..... Booth 54

POSTER SESSION 6
GWCC, Level III
Authors will be present from 0900 to 1100 hours

Marine Geology

Dennis V. Kent, Dann J. Spariosu:* Magnetostratigraphy of Caribbean Deep-Sea Sediments at Site 502: A Complete Late Miocene to Recent High Resolution Record ..... Booth 1
A. J. Fleet, M. Coleman:* The Nature and Genesis for Deep-Sea Carbonate Nodules from DSDP Site 503, Eastern Equatorial Pacific ..... Booth 2
Larry A. Mayer:* Closely Spaced Physical Property Measurements in 200 m Long Piston Cores from 2 Oceans: DSDP Hydraulic Piston Core Sites 502 and 503 ..... Booth 3
J. V. Gardner, W. L. Prell:* Detailed Carbonate Stratigraphies for the Late Neogene from the Caribbean and Eastern Equatorial Pacific: DSDP Leg 68–HPC ..... Booth 4
Herman B. Zimmerman, Warren L. Prell, James V. Gardner:* Mineral Stratigraphy of the Western Caribbean and Eastern Equatorial Pacific: DSDP Leg 68 ..... Booth 5
Michael T. Ledbetter, John C. Stormer, Jr.*:* Tephrachronology of Late Miocene to Recent Central American Explosive Eruptions Using DSDP Leg 68 Hydraulic Piston Cores ..... Booth 6
Warren L. Prell:* A Continuous High-Resolution Record of the Quaternary—Evidence for Two Climatic Regimes: DSDP Hydraulic Piston Core Site 502 ..... Booth 7
N. G. Pisias, T. C. Moore, Jr., G. Boden, J. Robertson:* Oceanographic and Atmospheric Response of the Northwest Pacific Sector to Variations in Global Climate during the Last 500,000 Years ..... Booth 8
Lawrence A. Krissek, Kenneth F. Scheidegger:* Composition, Sources, and Dispersal of Hemipelagic Sediment on the Oregon Continental Margin ..... Booth 9
Bonnie A. McGregor, Alan R. Bunn:* Erosional Control of the Morphology of the North Carolina Continental Slope by Valley Dissection and Mass Wasting ..... Booth 10

*Speaker

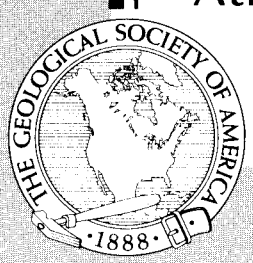
abstracts with programs

1980 ANNUAL MEETINGS
The Geological Society of America (93rd)

with

THE PALEONTOLOGICAL SOCIETY (72nd)
THE MINERALOGICAL SOCIETY OF AMERICA (61st)
THE SOCIETY OF ECONOMIC GEOLOGISTS (60th)
CUSHMAN FOUNDATION (31st)
GEOCHEMICAL SOCIETY (25th)
NATIONAL ASSOCIATION OF GEOLOGY TEACHERS (21st)
GEOSCIENCE INFORMATION SOCIETY (15th)

November 17–20, 1980
Georgia World Congress Center
and the Atlanta Marriott Hotel
Atlanta, Georgia



Volume 12 · Number 7 · August 1980 · Boulder, Colorado
GAAPBC 12(7) 313-568 (1980)