GRAPHICS, GAMES, AND GEOLOGY

№ 42873

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The increasing sophistication of graphics capabilities in personal computer systems promises to have a profound influence on the pedagogical approach employed in many undergraduate geology courses. Development or adoption of software must take into account the present capabilities and be designed to take advantage of what lies hidden in the immediate future. As software development is a time-consuming chore, programs written in the present must be sufficiently flexible to incorporate new components and techniques with little revision. The problems lie in assessing future capabilities. Doing nothing until those capabilities are realized results in enormous lost opportunity costs.

One approach useful in assessing those capabilities is to analyze the sophisticated graphics workstations of today. The capabilities of these workstations with regard to screen resolution, color palette, refresh times, processing routines in ROM, text overlays, computational capabilities, and input and output devices permit reasonable predictions about the system available for educational purposes in five years.

Another approach that is somewhat more immediate than the former is to assess the capabilities of personal computer systems by analyzing the most sophisticated computer games available for a particular system. These provide insight into screen layout flexibility, color detail of design elements, animation possibilities, and the challenge, complexity, and variety possible in a software package.

Projections based on these approaches provide realistic estimates of the graphics capabilities of the geologic classroom of 1990, the costs of equipping this classroom, and the types of learning activities that will be possible.

SHAPE AND DISCRIMINANT ANALYSES AS TOOLS FOR CLASSIFICATION OF FRESHWATER OSTRACODA

№ 39973

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Many fossil freshwater ostracodes from the Lake Michigan Formation (Holocene) closely resemble each other in various morphologic features with the exception of external shape. Because external shape is a major criterion for taxonomic delineation of these crustaceans, shape analysis (specifically, Fourier Analysis) and discriminant functional analysis (DFA) were conducted on three candonid forms (C. crogmaniana, C. rawsoni, and C. subtriangulata) to determine if the quantified outline provided sufficient, objective information for classification.

Discriminant analysis of 132 data-set combinations for the candonid phenotypes resulted in 84 interspecific discriminations with perfect assignments in the testing classes; 11 discriminations with greater than 85% accuracy in the testing classes. In addition, intraspecific combinations of male and female dimorphs resulted in 17 perfect assignments, three dimorphic combinations resulted in placements that were 96% accurate, and two placements that were greater than 84% accurate in the testing classes. Intraspecific comparisons of left and right valves for either male or female dimorph exhibited overlap and were poorly distinguishable with discriminant analysis.

Results indicate that the values resulting from the Fourier series have the potential to describe accurately the shapes of freshwater ostracodes, and that the quantified two-dimensional outlines of these organisms contain significant information for taxonomic classification and morphologic delineation. Phenotypic data sets that overlap may provide information necessary for the recognition of morphotypes that belong to the same species. Such results suggest that large studies on freshwater and marine organisms are warranted, and contain much potential for taxonomic classifications.

DO ATLANTIC - TYPE MARGINS CONVERT DIRECTLY TO ANDEAN MARGINS?

№ 52598

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Since Wilson's recognition of cycles of oceans opening and closing many authors have assumed that in mountain belts where oceans have closed that the closure started with the failure of a passive (Atlantic - type) margin and the formation of a convergent (Andean - type) margin. Subsequent, studies have shown that the Andean margins usually develop not as the result of subduction under a previous Atlantic type margin but rather from an arc - continent collision followed by a change in subduction polarity and the development of an Andean - type margin. A survey of orogenic belts around the globe was undertaken to try to locate any Atlantic margins that have converted directly to Andean margins. Most of the areas studied (e.g. Taconic and Brooks Range Orogens) were affected by an island arc collision before an Andean phase of convergence. Of 25 belts studied only 2 appear to have resulted from direct conversion. One margin is in southern Tibet and went through its conversion about 120 Ma ago, colliding with the northern Indian Atlantic - type margin about 40 Ma ago. The other example is the Anatolide - Pontide Orogen in northern Turkey. Here the arc was constructed directly above the sedimentary prism of the previous Atlantic type margin.The general lack of direct conversion from Atlantic to Andean margins suggests that sediment loading and the high density of old oceanic lithosphere is not sufficent cause for failure at Atlantic - type margins. Recent geological and geophysical work has suggested that these direct conversions only occur at margins which are young where the oceanic lithosphere is hot, thin and weak. It has been suggested that subduction for island arcs commonly starts at a spreading ridge - transform system, where the oceanic lithosphere is thin. Similarly, the direct conversion of Atlantic-type to Andean margins may only happen where the margin is young and the adjacent oceanic lithosphere is thin and weak. Studies of the geological fate of other examples of old Atlantic - type margins are needed to test the hypothesis that rifted margins do not generally convert directly to Andean margins.

APPLICATIONS OF GEOPHYSICAL EXPLORATION TECHNIQUES TO STRUCTURAL INTERPRETATIONS AT THE NEVADA TEST SITE

№ 33536

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Geophysical techniques have been used at the Nevada Test Site to aid in making geologic interpretations in a complex setting. Yucca Flat is underlain by Paleozoic rocks and filled with Tertiary volcanics and Quaternary/Tertiary alluvium. When compared to sedimentary basins common to the petroleum industry it has unusual and unique geophysical characteristics. Applications of borehole gravity and magnetic logging and adaption of surface seismic reflection techniques result in greater resolution of subsurface structures.

The borehole magnetometer measures the magnetic intensity in the borehole. Individual volcanic units have characteristic magnetic signatures, permitting rapid identification of units and more accurate definition of their contacts, resulting in correlations between boreholes that are superior to those made by other logging techniques.

The borehole gravimeter is routinely employed to limit and refine subsurface structural interpretations based on geologic data. Downhole gravity measurements are more sensitive than surface gravity surveys to the presence of subsurface structures, near the borehole.

Surface seismic reflection techniques have been adapted from standard petroleum exploration for the unique acoustic properties of the alluvium and volcanics. Careful selection of field acquisition and processing parameters have enabled LLNL to image the buried volcanic section. Structural interpretations have been greatly improved with data obtained from the seismic sections.

Work performed under auspices of DOE by LLNL under contract #W7405-ENG-48

INCREMENTAL AND FINITE STRAINS WITHIN DUCTILE SHEAR ZONES, NARRAGANSETT BASIN, RI

№ 50004

BURKS, Rachel J., Department of Geological Sciences, The University of Texas at Austin, Austin, Texas 78713

Pennsylvanian metasediments of the Narragansett Basin of MA and RI record a complex history of Permian deformation, two compressive events (D1 and D2) followed by two shear-related deformations (D3 and D4). Within the Beaverhead Shear Zone (BHSZ), the latter two events produced multiple phases of folding, boudinage, and superposed crenulation cleavages associated with strike-slip and oblique faulting. Overprinting relationships of cleavages within an individual zone indicate sequence of formation and sense of shear. Internal geometries of superposed cleavages (i.e., dihedral angles between crenulation axes and poles to associated planes) predicted from models of progressive simple shear correspond to observed geometries and serve as shear strain gauges.

Shear-related crenulations should theoretically initiate at 45° to the shear zone boundary and perpendicular to the shortening direction of the associated finite strain ellipsoid. The observed value is typically 41° because a certain amount of buckling must occur before the crenulations are observable. The orientation and morphology of each cleavage generation provides a measure of the incremental strain associated with progressive shear prior to formation of the next cleavage. Dihedral angles and microfold shapes of sinistral D3 crenulations reflect shear strain (γ) values ranging from 3 to 6 along portions of the BHSZ, despite consistency in associated buckling strains of 8-10%. Similar values are obtained for D4 dextral crenulations in the same area.

Finite strains from pebble metaconglomerates along a traverse across the BHSZ are approximately 2:1:0.3, showing little variation within the outside the zone because pebble shapes primarilly reflect D1 deformation by pressure solution and synmetamorphic plastic flow.

CRYSTAL CHEMISTRY OF FERRIC MICAS

№ 52614

BURNS, Roger G. and DYAR, Melinda Darby, Department of Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, MA 02139

Ferruginous micas studied previously by Mossbauer spectroscopy have raised several problems concerning nomenclature of ferric-bearing micas, designations of cation positions, Fe^{3+} occupancies of the cis-M2 and trans-M1 octahedral sites, the occurrence of tetrahedral Fe^{3+} in micas containing a surplus of (Si+Al), precision of Fe^{3+}/Fe^{2+} ratios, and undue scatter of isomer shift and quadrupole splitting parameters. Recently improved precision in acquiring and fitting of

10 **Kevin D. Voss-Roberts*:** EVOLUTIONARY RELATIONSHIPS AND BIOSTRATIGRAPHY OF SILENIS (OSTRACODA) FROM THE SILURIAN OF GOTLAND [47523] ..... 10:15 A

11 **Thomas M. Cronin*:** CLIMATIC MODULATION OF EVOLUTION IN MARINE OSTRACODES [51042] ..... 10:30 A

12 **Collette Burke*, William E. Full:** SHAPE AND DISCRIMINANT ANALYSES AS TOOLS FOR CLASSIFICATION OF FRESHWATER OSTRACODA [39973] ..... 10:45 A

13 **Robert C. Grayson, Jr.*, William T. Davidson, Edwin H. Westergaard, Stacy C. Atchley, Jay H. Hightower, Preston T. Monaghan, Craig D. Pollard:** MISSISSIPPIAN-PENNSYLVANIAN BOUNDARY CONODONTS FROM THE RHODA CREEK FORMATION, OKLAHOMA [40962] ..... 11:00 A

14 **Norman M. Savage*:** PROVINCIAL AFFINITIES OF CONODONT FAUNAS FROM THE ALEXANDER TERRANE, SOUTHEASTERN ALASKA [18301] ..... 11:15 A

15 **Linda E. Tway*, P.S. Doyle, W.R. Riedel:** CORRELATION OF DATED AND UNDATED PACIFIC SAMPLES BASED ON ICHTHYOLITHS AND CLUSTERING TECHNIQUES [50617] ..... 11:30 A

POSTER SYMPOSIUM: COCORP AND REFLECTION SEISMOLOGICAL INFORMATION ON THE BASIN AND RANGE REGION
MGM Arcade Hallway, 8:00 a.m. - 5:00 p.m. daily

A speaker will be present from 11:00 a.m. to 12:00 noon daily

1 **T. Hauge*, R. Allmendinger, S. Burgess, C. Caruso, A. Gibbs, E. Hauser, J. Huang, S. Klemperer, C.-S. Liu, K. Nelson, S. Opdyke, C. Potter, W. Sanford, L. Serpa, L. Zehng, T. Zhu, L. Brown, S. Kaufman, J. Oliver:** THE COCORP 40 DEGREE N TRANSECT OF THE NORTH AMERICAN CORDILLERA: PART 1 [33491] ..... 11:00 A

2 **E. Hauser*, R. Allmendinger, S. Burgess, C. Caruso, A. Gibbs, T. Hauge, J. Huang, S. Klemperer, C.-S. Liu, K. Nelson, S. Opdyke, C. Potter, W. Sanford, L. Serpa, L. Zheng, T. Zhu, L. Brown, S. Kaufman, J. Oliver:** THE COCORP 40 DEGREE N TRANSECT OF THE NORTH AMERICAN CORDILLERA: PART 2: [33492] .... 11:00 A

3 **C. Potter*, R. Allmendinger, S. Burgess, C. Caruso, A. Gibbs, T. Hauge, E. Hauser, J. Huang, S. Klemperer, C.-S. Liu, K. Nelson, S. Opdyke, W. Sanford, L. Serpa, L. Zheng, T. Zhu, L. Brown, S. Kaufman, J. Oliver:** THE COCORP 40 DEGREE N TRANSECT OF THE NORTH AMERICAN CORDILLERA: PART 3: [33493] .... 11:00 A

TECTONICS I: GENERAL AND OLD WORLD
Adelphi, MGM, 8:00 a.m.

Kevin Burke and Robert J. Lillie, Presiding

1 **Kevin Burke*, W.S.F. Kidd, L. Bradley:** DO ATLANTIC-TYPE MARGINS CONVERT DIRECTLY TO ANDEAN MARGINS? [52598] ..... 8:00 A

2 **Mark Cloos*, Ronald L. Shreve:** QUANTITATIVE MODELING OF SEDIMENT SUBDUCTION, MELANGE FORMATION, AND ACCRETION AT CONVERGENT PLATE MARGINS [50008] ..... 8:15 A

3 **Robert J. Lillie*:** PRESERVATION OF RIFTED MARGINS BENEATH THRUST SHEETS IN COLLISIONAL MOUNTAIN BELTS [52884] ..... 8:30 A

4 **Sarah Eldredge, Rob Van der Voo*, Valerian Bachtadse:** OROCLINES: PALEOMAGNETIC EVIDENCE FOR BENDING [50384] .... 8:45 A

5 **Michelle A. Kominz*, Gerard C. Bond:** THERMAL MODELING OF FORELAND BASINS: EFFECTS ON FLEXURE AND UPLIFT [40126] ..... 9:00 A

6 **Celal Sengor*, Kevin Burke:** AN ESTIMATE OF THE AMPLITUDE OF GLOBAL SEA LEVEL CHANGE ASSOCIATED WITH THE BREAK BETWEEN THE OLDER AND YOUNGER CRETACEOUS GLOBAL SUPER CYCLES [40023] ..... 9:15 A

7 **Brian M. Whiting*, Richard A. Laws, Robert M. Ressetar:** THE GULF OF SUEZ: A NEW INTERPRETATION BASED ON SUBSIDENCE MODELING [51097] ..... 9:30 A

8 **Stephen K. Perry*, Steven Schamel:** LOW-ANGLE DETACHMENT AND ISOSTATIC COMPENSATION IN THE GULF OF SUEZ, EGYPT [52475] ..... 9:45 A

9 **Hassan T. Abuzied*:** WADI HAMRAWIN: A POSSIBLE EXTENSION OF THE NAJD WRENCH FAULT ZONE OF SAUDI ARABIA INTO THE EASTERN DESERT OF EGYPT [52273] ..... 10:00 A

10 **Daniel R. Sarewitz*, Daniel E. Karig:** NATURE AND TIMING OF TERRANE AMALGAMATION ON MINDORO ISLAND, PHILIPPINES [51763] ..... 10:15 A

11 **Eric W. Law*, James L. Aronson:** TIMING OF METAMORPHISM OF THE TAIWAN GEOSYNCLINE AND ITS COLLISION WITH THE LUZON ARC [48465] ..... 10:30 A

12 **M.J. Cheadle*, M.R. Warner, D.H. Matthews:** THRUST FAULT REACTIVATION - EVIDENCE FROM BIRPS DATA [42708] ..... 10:45 A

13 **Nebil I. Orkan*, Mark Jancin, K.D. Young, Barry Voight:** PALEOMAGNETIC TEST OF REGINAL SHEAR ROTATION ALONG SOUTHERN MARGIN OF TJÖRNES FRACTURE ZONE, ICELAND [43604] ..... 11:00 A

14 **Scott G. Borg*, Bruce W. Chappell, Malcolm T. McCulloch, Edmund Stump, Doone Wyborn, John R. Holloway:** COMPOSITIONAL POLARITY OF GRANITOIDS WITH IMPLICATIONS TO REGIONAL GEOLOGY, NORTHERN VICTORIA LAND, ANTARCTICA [52397] ..... 11:15 A

POSTER SESSION I
Fronton Foyer, MGM, 8:00 a.m. - 11:30 a.m.

Authors will be present from 9:00 a.m. - 11:00 a.m.

STRUCTURE/TECTONICS

Nicholas M. Short*, P.D. Lowman, P. Whiting, A. Lohmann, G. Lee: REGIONAL FRACTURE PATTERNS IN THE CANADIAN SHIELD: A LANDSAT STUDY [41309] ..... Booth 1

Peter J. Whiting*, Timothy D. Schoonmaker: URANIUM-SERIES DATING AND QUATERNARY VERTICAL MOVEMENTS: SOUTHEASTERN COAST, DOMINICAN REPUBLIC [36161] ..... Booth 2

J.D. O'Leary*, M.B. Underwood, R.H. Strong: TECTONIC BURIAL OF FRANCISCAN STRATA WITHIN NORTHERN CALIFORNIA [37392] ..... Booth 3

Richard L. Mauger*: LARAMIDE AND TERTIARY EXTENSIONAL FAULTING IN THE BASIN-AND-RANGE AREA OF CENTRAL CHIHUAHUA, MEXICO [40075] ..... Booth 4

Gerard C. Bond*, Peter A. Nickeson, Michelle A. Kominz: BREAKUP OF A SUPERCONTINENT BETWEEN 625 AND 555 MA: NEW EVIDENCE AND IMPLICATIONS FOR CONTINENTAL HISTORIES [42945] ..... Booth 5

Ibrahim Cemen*, L.A. Wright, R.E. Drake, F.C. Johnson: CENOZOIC DEFORMATION AND SEDIMENTATION, SOUTHEASTERNMOST PART OF THE FURNACE CREEK FAULT ZONE, DEATH VALLEY, CALIFORNIA [43598] ..... Booth 6

D.A. Archibald*, E. Farrar: GEOCHRONOLOGY AND TECTONIC IMPLICATIONS OF MAGMATISM AND METAMORPHISM, SOUTHEASTERN BRITISH COLUMBIA [46870] ..... Booth 7

R.L. Bartel*, J.S. Oldow: EARLY TO MIDDLE(?) JURASSIC GROWTH FAULTING IN THE PILOT MOUNTAINS, WEST-CENTRAL NEVADA: EVIDENCE FOR MESOZOIC BACK-ARC EXTENSION [47423] ..... Booth 8

L.S. Brown*, J.S. Oldow: LATE MESOZOIC RAMP BACK-THRUSTS IN THE LUNING ALLOCHTHON AND POST-MID-CRETACEOUS LOW-ANGLE DETACHMENT FAULTS, NORTHERN CEDAR MOUNTAINS, WEST-CENTRAL NEVADA [47424] ..... Booth 9

Daniel J. Kontak*, Edward Farrar, Alan H. Clark, H. Baadsgaard: RADIOMETRIC EVIDENCE FOR A MAJOR PALEOGENE STRUCTURAL BREAK, CENTRAL ANDEAN EASTERN CORDILLERA [50855] ..... Booth 10

Kenneth S. Coles*, Robert J. Varga: LOWER TO MID-PALEOZOIC PHOSPHATIC CHERT/SHALE ASSOCIATION IN THE SOUTHERN CORDILLERA: WEST COAST TYPE [51702] ..... Booth 11

J. Lee*, E.L. Miller, L.D. Rowles, A.B. Marks: DEFORMATIONAL FABRICS AND STRAIN IN LOWER PLATE ROCKS OF THE SNAKE RANGE METAMORPHIC CORE COMPLEX, NEVADA [52092] ..... Booth 12

ABSTRACTS with PROGRAMS 1984

97th Annual Meeting

The Geological Society of America

The Paleontological Society (76th)
The Mineralogical Society of America (65th)
The Society of Economic Geologists (64th)
Cushman Foundation (35th)
Geochemical Society (29th)
National Association of Geology Teachers (25th)
Geoscience Information Society (19th)

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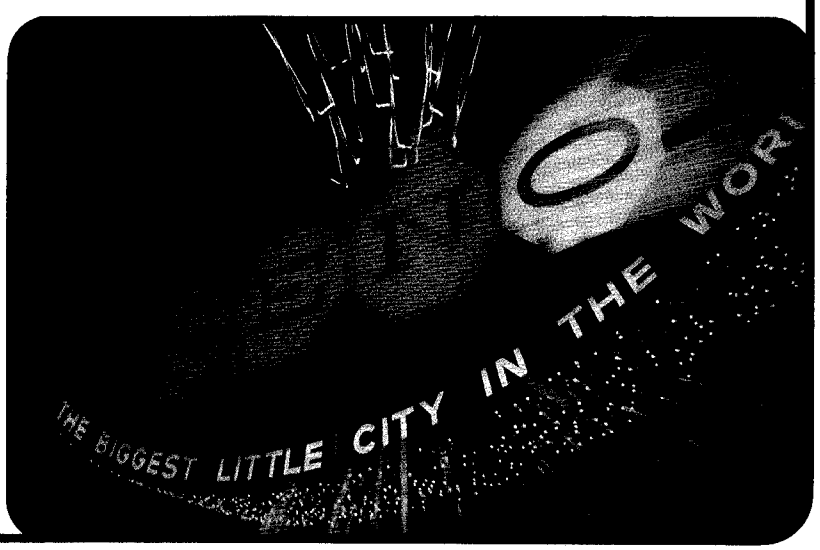

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