



Thirty-Fourth Annual

# **GEOSCIENCE DAY**

PROGRAM AND ABSTRACTS

GEOSCIENCE DEPARTMENT  
INDIANA UNIVERSITY OF PENNSYLVANIA

April 25, 2008  
Room 134 Weyandt Hall

Thirty-Fourth Annual

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# GEOSCIENCE DAY SCHEDULE

8:30 am      **Opening Remarks - Dr. Steven A. Hovan**

## **Session I** **Sedimentology & Oceanography**

8:40 - 9:00      **Nicholas M. Welsh**

CORRELATIVE LITHOSTRATIGRAPHY  
AND BIOSTRATIGRAPHY OF THE THIRD  
THROMBOLITIC INTERVAL OF THE  
CONOCOCHEAGUE FORMATION OF  
MARYLAND AND VIRGINIA

9:00 - 9:20      **Benjamin F. Schupp**

THE FORCES INVOLVED IN THE OPENING  
OF CALIFORNIA COASTAL LAGOONS

9:20 - 9:40      **Matthew P. Bolyn**

SURF ZONE TURBIDITY NEAR THE TIJUANA  
RIVER MOUTH IN SOUTHERN CALIFORNIA

9:40 - 10:00      **Howard C. Manski**

THE LONG TERM CLIMATE AND HISTORY  
OF THE SOUTHERN HEMISPHERE 18 MA TO  
PRESENT

10:00 - 10:10      **Refreshment Break**

## **Session II** **Structure, Tectonics & Geophysics**

10:10 - 10:30      **Michael A. Jarvis**

GEOMETRY AND KINEMATICS OF  
CONTEMPORARY NONRECOVERABLE STRAIN:  
CENTRAL TAIWAN

10:30 - 10:50      **Kalin McDannell**

CONSTRAINTS ON PULL-APART BASIN  
FORMATION FROM TECTONIC  
GEOMORPHOLOGY

10:50 - 11:10      **Jeffrey M. Dereume**

ELECTRICAL IMAGING OF A TRIASSIC  
FAULT SYSTEM IN NORTHERN NEW  
JERSEY

11:10 - 12:00      **Guest Presentation:**  
**Dr. David K. Brezinski, 1977**

INFLUENCES OF CLIMATE ON LATE  
DEVONIAN DEPOSITIONAL SYSTEMS  
OF THE CENTRAL APPALACHIANS

5:30

**Geoscience Banquet**  
**Rustic Lodge, Indiana, PA**

# **CORRELATIVE LITHOSTRATIGRAPHY AND BIOSTRATIGRAPHY OF THE THIRD THROMBOLITIC INTERVAL OF THE CONOCOCHIEGUE FORMATION OF MARYLAND AND VIRGINIA**

WELSH, Nicholas M.

The stratigraphic analysis of the lithologies below the basal boundary of Thrombolite (III) indicates that there was a gradual transgression or sequence of transgressions that preceded the third order transgressive event recorded by the deposition of a large package of subtidal thrombolite at the base the Thrombolite (III) interval. The presence of sub-meter scale transgressive cycles is expressed by two different lithologic trends. In the sequences consisting of alternating laminite and rhythmite, the reduction in the number and thickness of laminite components up section indicated transgression. The most conclusive evidence of transgression is the presence of small lenticular microbiolite bodies below the major body of Thrombolite (III).

The strata in proximity to the base of Thrombolite (III) were measured and sampled with sub-meter scale precision at two outcrops in two different geographic locations. The outcrops west of the 108 mile marker along the C&O Canal Historic Park (Four Locks) in Maryland and the exposure at Cooke's Pasture in the Northern Shenandoah Valley of Virginia were compared to one another in order to detect any regional variation.

Trilobite fossils were used to determine the biostratigraphy of the outcrops and correlate the sedimentary features between the geographically distributed exposures. The existence of the boundary between the Saratogia and Saukia trilobite zones within lower Thrombolite (III) was confirmed by the stratigraphic position of *Rassetti magna* at the Cooke's Pasture exposure.

# **THE FORCES INVOLVED IN THE OPENING OF CALIFORNIA COASTAL LAGOONS**

SCHUPP, Benjamin F.

Along the California coastline, large discharge events as well as wave and tidal highs, are known to open the ephemeral lagoons that close off due to seasonal precipitation in the region. However, little information was known regarding the specific roles of each of these factors in opening the lagoons. By analyzing the specific conditions that occurred at the time of a breach, for each of the rivers in question, and comparing these numbers to significant precipitation events, as well as local tide and wave heights, the cause of breach was able to be determined. For three of the six lagoon breach events examined, the breach occurred immediately following a sediment discharge on each of the rivers. In 2004, the Laguna River breached on the 22<sup>nd</sup> of October with non-unique wave, tide, and lagoon depth values. However, a major discharge event occurred three days prior to the breach, which increased the discharge on the river by 12.3 times the average. In 2005, Scott Creek experienced two breach events at separate times. The first occurred on December 2<sup>nd</sup>, which was the same day when major discharges were recorded that were 11 times the average. The second event, occurring on December 18<sup>th</sup>, represented an increase in discharge of 103.4 times the average. Data from the other three river mouth lagoons show no correlation with discharge, or with wave or tidal influence as a cause for breach. Instead, it seems reasonable to assume that humans are the controlling factor; dredging open the lagoons on an as-needed basis for flood control. The insights gained through this study will provide the necessary information to determine whether waiting for the onset of seasonal rains to open the lagoons is a feasible option or not.

## **SURF ZONE TURBIDITY NEAR THE TIJUANA RIVER MOUTH IN SOUTHERN CALIFORNIA**

BOLYN, Matthew P.

The beaches in southern California are altered by wind and waves in a perpetual process of creation and erosion. Seasonal cycles of sand deposition and loss can often affect the appearance of beaches from summer to winter. During times of violent storm waves these beaches can be severely altered. Most of the natural beach sands in this region originate from the area's rivers. Sediment delivery to the coast is dominated by episodic river floods.

The primary goal of this project was to determine the environmental factors leading to surf zone turbidity near the Tijuana River mouth. Aerial images of the coast were obtained from Ocean Imaging Inc. These images were viewed to determine whether surf zone turbidity is dominated by coastal wave induced turbidity, river plume turbidity or times of reduced turbidity/no turbidity. Wave data, river discharge data, and tide data were analyzed to determine what causes surf zone turbidity in the area. Wave heights were higher than average on the dates when the aerial images document coastal-dominated turbidity, especially during the winter months. Wave heights are also higher than average on the dates when the aerial images document river plume turbidity. Wave period remains about the same during all the dates of the images. River discharge was the highest during the winter months. The data suggest that the surf zone turbidity is caused by the river and waves, with each dominating during different periods of time.

## **THE LONG TERM CLIMATE AND HISTORY OF THE SOUTHERN HEMISPHERE 18 MA TO PRESENT**

MANSKI, Howard C

Eolian transported dust is deposited as deep sea pelagic sediment across the globe. Blankets of eolian sediment on the ocean floor accumulate in deep sea canyons and bathometric depressions undisturbed for millions of years, giving geologists a great source to determine long term paleoclimate. By analysis of flux determinations and grain size, used to calculate transporting wind intensity, past aridity of the sediment source region can be determined. Data used was taken from the deep sea piston core (MV0502-core 01JC) from the Marlin Rise region of the south west Pacific. Strontium isotope ichthyolith stratigraphy of the core, provided time and age constraints of the pelagic clay dating back eighteen million years. Using percent composition, dry bulk density, and a linear sedimentation rate, a mass accumulation rate can be determined. With this information, we can estimate the paleoclimate of the southern hemisphere and its changes in aridity throughout the past eighteen million years.

## GEOMETRY AND KINEMATICS OF CONTEMPORARY NONRECOVERABLE STRAIN: CENTRAL TAIWAN

JARVIS, Michael A.

Irregularity along plate boundaries is becoming better understood and with this comes the need to better constrain the kinematics of collision systems. The collision of the Luzon arc and the passive margin of the Eurasian continental plate is responsible for the creation of the island of Taiwan starting approximately 4 Ma. The collision zone is interpreted to be a continental margin fracture zone in west central Taiwan, but its crustal architecture is not clearly defined. Using magnetic anomaly data, a clear offset can be defined between the continental crust in Taiwan and the fracture zone. This fracture zone is likely a relict of earlier extension as a passive margin, reactivated during collision.

Seismic events and the underlying kinematics of earthquake focal mechanisms can be utilized to constrain the geometries of structures reactivated by collision. The working conceptual model is that the plate convergence vector is rotated counter clockwise with the hypothesis that transpressional structures dominate in west-central Taiwan. The spatial distributions of events will lead us to an understanding that strain is partitioned at fine spatial scales into regimes of thrusting and wrenching.

## CONSTRAINTS ON PULL-APART BASIN FORMATION FROM TECTONIC GEOMORPHOLOGY

MCDANNELL, Kalin T.

The opening history of the Pejibaye pull-apart basin, an active tectonic feature, in central Costa Rica, can be documented using geochronology, mapping, geographic information systems, and techniques in geomorphology. This region is located at a releasing bend in the active Tucurrique fault and has been shown to be undergoing contemporary horizontal stretching. This is accommodated by a system of active strike-slip faults related to collision of the thickened Cocos aseismic ridge at the Middle America Trench. Whereas research has been done extensively on pull-apart basins in marginal marine or arid settings, there has been little work done in humid, subtropical settings such as Costa Rica. Central Costa Rica also provides the opportunity to analyze the evolution of a geologically short-lived depocenter.

I use well-developed fluvial terrace deposits at the confluence of three rivers (Pejibaye, Gato & Tepemechin) flowing into the basin to document basin activity. The sediments that are in the basin contain organic-rich matter as well as silt and sand horizons. The techniques used in documenting these basin components are radiocarbon dating and optically stimulated luminescence dating. These methods provide data to determine burial dates for terraces and rates of sedimentation in the pull-apart. Also, because one of the rivers of interest, the Tepemechin River, shows an irregular basin-margin configuration, this work will give the opportunity to record the interaction between fluvial systems and faulting. These results are important for long term goals of obtaining slip rates on major faults in the urban corridor of Costa Rica.

## ELECTRICAL IMAGING OF A TRIASSIC FAULT SYSTEM IN NORTHERN NEW JERSEY

DEREUME, Jeffrey M.

A functional understanding of the geology and hydrogeology of a fault zone in Kenvil, New Jersey, supports the future development of a brown-field site. Continuous vertical electrical sounding (CVES) imaged early Triassic normal faults on the southeastern side of Mount Arlington Ridge, part of the northeast-southwest trending ridges within the New Jersey Highlands physiographic province of north-central New Jersey. The site had been previously characterized with a regional normal (down to the east) fault, the Longwood Valley Fault that places undefined Proterozoic bedrock units against the sandstone/conglomerate Silurian Green Pond Formation. The sandstone/conglomerates of the older Cambrian Hardyston Formation conformably overlie the Green Pond Formation. The Hardyston with the overlying Leithsville Formation and veneer of Pleistocene-aged glacial deposits comprises most of Long Valley within the study area.

CVES profiles collected normal to the Longwood Valley Fault show displacement within the Mesozoic sediments that are beneath the Pleistocene-aged glacial sediments in the contiguous valley. This previously unnamed fault system is termed the Kenvil Works Fault. Further, four or more synthetic faults exist between the Kenvil Works Fault and the Longwood Valley Fault. These faults accommodate right-rotational torsion between the two fault systems. The synthetic faults and Kenvil Works Fault System can act as a migration pathway for the movement of groundwater from the upland impermeable bedrock to the more permeable valley-fill sequences. The understanding of this geologic/hydrogeologic interaction within the facility will prove geologically and environmentally beneficial.

## INFLUENCES OF CLIMATE ON LATE DEVONIAN DEPOSITIONAL SYSTEMS OF THE CENTRAL APPALACHIANS

BREZINSKI, Dr. David K.

The stratigraphic change in lithology within the upper part of the Catskill-Hampshire succession in the central Appalachians suggests the onset of a long-term environmental change from semiarid to increasingly wet conditions. The sedimentological signature suggesting increased climatic wetness within the uppermost Catskill and Hampshire formations is nearly contemporaneous with the initiation of Late Devonian Gondwanan glaciation in the paleo-high-latitudes. The Appalachian climate record indicates that this change began in late Famennian, reaching its peak during the latest Devonian when glacial deposits are recorded in the paleo-mid-latitudes of the Appalachian Basin. Evidence of this late Famennian increase in precipitation also is recorded in the adjacent marine environments. Equivalent-age marine units in Ohio and Kentucky record progressive increases in both total organic carbon and the percentage of terrestrially-derived organic carbon. This suggests that while Late Devonian glaciers were forming in higher altitudes of the Appalachian Basin, attendant increases in both precipitation and runoff led to both increased terrestrial and marine organic productivity. This in turn led to heightened levels of organics being buried in the adjacent marine environments.

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