2006 Philadelphia Annual Meeting (22–25 October 2006)

Paper No. 92-5

Presentation Time: 2:30 PM-2:45 PM

DETACHMENT FAULT AND SHEAR ZONE OF THE CRETAN-PELOPONNESE RIDGE IN KYTHERA ISLAND

MARSELLOS, Antonios E., Department of Earth & Atmospheric Sciences, State University of New York at Albany, 1400 Washington Ave, Albany, NY 12222, am214525@albany.edu and KIDD, W.S.F., Earth & Atmospheric Sciences, Univ at Albany, Albany, NY 12222

Kythera Island is located on the prominent submarine horst between Crete and the Peloponnese in the southwestern part of the Aegean. The structure of Kythera is characterized by a pile of tectonic slices derived from different paleogeographic zones. The upper unmetamorphosed units comprise pelagic limestones and cherts of Pindos zone emplaced by thrusting in the Eocene on top of Tripolis zone neritic limestones. These units are separated from the lower metamorphosed unit of Phyllite-Quartzite (PQU) exposed in the northern part of Kythera by an extensional detachment fault of Late Miocene age. The lower tectonic unit of PQU was affected by high-pressure/low-temperature blueschist metamorphism during or after the middle Miocene, but the higher non-metamorphic carbonate units were affected only by local recrystallization. Both brittle and ductile structures related to the extensional detachment can be mapped near the contact of the contrasting metamorphic and non-metamorphic units. Brittle extension is expressed in the cover rocks by dominant NW-SE striking normal faults and related veins and breccias. Ductile structures in the metamorphic unit include mylonites and prominent ductile stretching fabrics which have in different places components of NW-SE and NE-SW extension. Pliocene sediments are mostly horizontal and cover the detachment unconformably. Extension was presumably related to rapid subduction rollback, as previously suggested by others. Differential movement of and vertical axis rotation in the Crete-Peloponnese ridge during this process may be linked to cross-ridge strike slip faults. Evidence of NE-SW dextral faulting is seen in northern Kythera outcrops, related to a significant fault of this type between Kythera and the Peloponnese.

2006 Philadelphia Annual Meeting (22–25 October 2006)
General Information for this Meeting

Session No. 92
Tectonics I
Pennsylvania Convention Center: 108 A
1:30 PM-5:30 PM, Monday, 23 October 2006

Geological Society of America *Abstracts with Programs*, Vol. 38, No. 7, p. 238

units form a highly displaced allochthon that has been carried onto a footwall succession essentially continuous with that of the foreland Apulian Platform. The buried Apulian carbonates (6-8 km thick) are deformed by relatively low-displacement, high-angle reverse faults probably involving the basement. Therefore, a switch from thin-skinned to thick-skinned thrusting appears to have occurred as the Apulian carbonates – and the underlying thick continental lithosphere – were deformed. Apatite fission track data, showing cooling ages below the closure temperature (ca. 120 °C) ranging between 9.2±1.0 and 1.5±0.8 Ma, indicate that exhumation was associated with this final stage of orogenesis (full continental collision), probably involving buttressing of the allochthonous wedge against the outer crustal ramp of the inherited rifted margin of the Lagonegro Basin. Subsequent (Pliocene to Early Pleistocene) foreland advancing of the allochthonous units largely exceeds the total amount of slip that, based on cross-section balancing and restoration, could be transferred from the buried Apulian carbonates to the overlying allochthon. This suggests that emplacement of the allochthon on top of the foreland Apulian carbonates was followed by gravity spreading of the weak allochthonous wedge. Extensional faults tend to branch onto pre-existing thrust faults. These were likely reactivated as low-angle extensional detachments controlling tectonic exhumation, as suggested by thermal indicators locally recording tectonic omission across them.

92-4 **2:15 PM** Sengör, A.M. Celâl

WIDESPREAD AREAL EXTENSIONAL VOLCANISM ATOP A SHORTENING OROGEN: IMPLICATIONS FOR CRUSTAL EVOLUTION

SENGÖR, A.M. Celâl, Avrasya Yerbilimleri Enstitüsü, Istanbul Teknik Üniversitesi, Ayazaga, Istanbul 34469 Turkey, sengor@itu.edu.tr

A widespread area (about 1/4 million square kilometres) became covered by volcanics with an average thickness of 1 km during the 11Ma to the present interval in eastern Turkey. Much of the volcanism occurred during the 11 to 2 Ma ago interval and almost all of it was alkalic in chemistry with some calc-alkalic volcanics in the north. The rocks erupted ranged from trachytes to basalts but subordinate amounts of phonolites have also been recorded. In the Quaternary, volcanicity became more localised around major eruptive centres, but these centres were also not confined to any lines and were randomly distributed in the area.

The region affected by volcanism is a high plateau where intensive north-south shortening after the Arabia/Eurasia collision has been going on since the end of the Oligocene expressed by widespread folding, thrusting and strike-slip faulting. There has been very minor north-south striking normal falting indicating east-west extension. Only one of the youngest stratovolcanoes can be shown to have been nucleated on a north-south striking fissure.

The type of volcanism in eastern Turkey has remained typical of areas of crustal thinning, mantle upwelling, and adiabatic melting, while the underlying crust was actively shortening, thickening and cooling. This anomaly is believed to result from the presence under the volcanic terrain of an initially about 25 km thick accretionary wedge overying a subducting oceanic lithosphere. Following the Arabia/Eurasia collision the oceanic lithosphere progressively steepened from north to south and eventually detached, sucking the asthenosphere towards the underbelly of a thin accretioanry prism. While being thus sucked, the asthenosphere rose and became adiabatically decompressed leading to widespead melting and basalt generation under the accretionary complex. This led to widespread heat introduction into the thickening accretionary complex and to its melting. The "extensional" signature comes from the adiabatic melting of the asthenosphere whereas the observed crustal additions come from this melting. This sort of areal volcanism owing to slab rollback and detachment after collisions is more widespread, especially in Turkic-type orogens, than hitherto reported.

92-5 **2:30 PM** Marsellos, Antonios E.

DETACHMENT FAULT AND SHEAR ZONE OF THE CRETAN-PELOPONNESE RIDGE IN KYTHERA ISLAND

MARSELLOS, Antonios E., Department of Earth & Atmospheric Sciences, State University of New York at Albany, 1400 Washington Ave, Albany, NY 12222, am214525@albany.edu and KIDD, W.S.F., Earth & Atmospheric Sciences, Univ at Albany, Albany, NY 12222

Kythera Island is located on the prominent submarine horst between Crete and the Peloponnese in the southwestern part of the Aegean. The structure of Kythera is characterized by a pile of tectonic slices derived from different paleogeographic zones. The upper unmetamorphosed units comprise pelagic limestones and cherts of Pindos zone emplaced by thrusting in the Eocene on top of Tripolis zone neritic limestones. These units are separated from the lower metamorphosed unit of Phyllite-Quartzite (PQU) exposed in the northern part of Kythera by an extensional detachment fault of Late Miocene age. The lower tectonic unit of PQU was affected by high-pressure/low-temperature blueschist metamorphism during or after the middle Miocene, but the higher non-metamorphic carbonate units were affected only by local recrystallization. Both brittle and ductile structures related to the extensional detachment can be mapped near the contact of the contrasting metamorphic and non-metamorphic units. Brittle extension is expressed in the cover rocks by dominant NW-SE striking normal faults and related veins and breccias. Ductile structures in the metamorphic unit include mylonites and prominent ductile stretching fabrics which have in different places components of NW-SE and NE-SW extension. Pliocene sediments are mostly horizontal and cover the detachment unconformably. Extension was presumably related to rapid subduction rollback, as previously suggested by others. Differential movement of and vertical axis rotation in the Crete-Peloponnese ridge during this process may be linked to cross-ridge strike slip faults. Evidence of NE-SW dextral faulting is seen in northern Kythera outcrops, related to a significant fault of this type between Kythera and the Peloponnese.

92-6 **2:45 PM** Grasemann, B.

A NEWLY IDENTIFIED, OPPOSITE SENSE AEGEAN CRUSTAL BLOCK PERSISTENT SINCE THE EOCENE REQUIRES KEY REVISIONS TO E-MEDITERRANEAN GEODYNAMICS MODELS

GRASEMANN, B.[1], EDWARDS, M.A.[2], SCHNEIDER, D.A.[3], IGELSEDER, Ch.[4], ZÁMOLYI, A.[2], PETRAKAKIS, K.[5], RAMBOUSEK, Ch.[2], MUELLER, M.[2], VOIT, K.[1], and THOENI, M.[1], (1) Department of Geodynamics and Sedimentology, Structural Processes Group Vienna, University of Vienna, Althanstrasse 14/2B447, Vienna, 1, Bernhard.Grasemann@univie.ac.at, (2) Structural Processes Group Vienna, Vienna, 1, Austria, (3) Department of Geological Sciences, Ohio Univ, Athens, OH 45701, (4) Structural Processes Group, Vienna, 1, Austria, (5) UZA - Universitätszentrum Althanstraße, Wien, 1, Austria

Eastern Mediterranean geodynamics afford collisional tectonic features ranging from world-class blueschists to subsequent, collapse-engendered lithospheric detachments with anatexis and metamorphic-core-complexes (MCC's), to the present day intense seismicity, striking SLR/GPS-constrained angular velocities and lucid slab tomography. Composite models spanning the Cenozoic history from early high-pressure exhumation to active crustal block rotations typically employ a continued N-NE subducting Africa slab with S-SW-directed terrane plus nappe-stacking and N-NE directed syn-convergent extension (associated with the renowned Aegean MCC's). Data on the nature, distribution and duration of kinematic regimes for these models are pivotal for their geodynamics predictions (e.g. cause versus effect for Hellenic slab-trench retreat vesus Anatolian escape).

Project ACCEL (Aegean Core Complexes along an Extended Lithosphere) presents data from the hitherto geodynamically ill-considered W-Cyclades that identifies a S-SW-directed realm of crustal extension with multiple anatexes and crustal failures that are protracted across Eocene to Late Miocene. On Serifos island, P/T conditions (from petrology and deformation mechanisms) with preliminary zircon U-Pb TIMS crystallisation ages as well as mica Rb-Sr cooling ages reveal a syn- to post-detachment granodiorite with late dyke offshoots and an associated top-to-SSW, mid-upper crustal conditions mylonitic detachment, all of which cross-cut a top-to-SSW, lower-mid crustal conditions high strain zone that mylonitises an S-type granite whose zircons give an ion microprobe U-Pb late Eocene crystallisation age (probably pushing back to Eocene the interval of known Cycladic granitic plutonism). A further top-to-SW high-strain detachment fabric discovered on Kea and consistent kinematics from compiled data for Kithnos and Lavrio reveal that the W-Cyclades is a hitherto unrecognised, roughly 2000x100 km lithospheric extension region (or microplate) that was persistent since the Eocene and, critically, has opposite sense to the NNE-directed Hellenic nappe stacking and detachment kinematics of the E-Cyclades microplate.

92-7 **3:00 PM** Wood, Warren W.

RAPID RISE (~3 MM/Y) OF COASTAL ABU DHABI

WOOD, Warren W.[1], STOKES, Stephen[2], BRANDT, Danita[1], KRAEMER, Thomas F.[3], and IMES, Jeffery L.[4], (1) Geological Sciences, Michigan State University, 206 Natural Sci. Building Department of Geological Sciences, East Lansing, MI 48824, wwwood@msu.edu, (2) School of Geography and the Environment, Univ of Oxford, Mansfield Road, Oxford OX1 3TB, (3) Water Resources Division, U. S. Geol Survey, MS 430, National Center, 12201 Sunrise Valley Drive, Reston, VA 20192, (4) USGS-NDC Ground Water Research Program, National Drilling Co, P.O. Box 15287, Al Ain, United Arab Emirates

Dating of elevated marine deposits on the coastal sabkha of the Emirate of Abu Dhabi, UAE suggests that land surface has risen 80 m in ~25,000 years (~3 mm/y). The age (24,200 through 28,200 yr BP) and elevation that average 5 m above current mean sea level were measured on three zeugen (marine-carbonate capped table-like structures). Sea level at the time of deposition was ~75 m lower than present; thus, the zeugen represent an uplift of nearly 80 m. The carbonate caprock is composed of ooids, gastropods, and mollusks and contains coralline algae and benthic foraminifera. Fossil assemblage, strontium, carbon, and uranium isotope ratios are consistent with a marine origin of the carbonate caprock that unconformably overlie eolian dunes. The contact between the caprock and eolian deposit (43,000 years) is a high-energy irregular erosional surface with over 20 cm of vertical relief in 3 m. Optical stimulation luminescence on eolian quartz grains and calibrated radiocarbon dating of shells were used to determine the ages. Progradation of the Abu Dhabi coastal sabkha into the Arabian Gulf is consistent with uplift in the area. The rapid rise may be directly related to convergence or to isostatic uplift associated with erosion in the Zagros Mountains; data collection from a wider area will help to distinguish between these possibilities. Zeugen are found at approximately the same elevation along the 300-km coastline of the Emirate of Abu Dhabi, thus their rise is unlikely to result from salt diapirs.

92-8 **3:15 PM** Robinson, Alexander C.

LARGE-SCALE UNDERTHRUSTING AT THE WESTERN END OF THE INDO-ASIAN COLLISION ZONE: EVIDENCE FROM THE EASTERN MARGIN OF THE PAMIR

ROBINSON, Alexander C.[1], YIN, An[1], MANNING, Craig E.[1], HARRISON, T. Mark[1], and WANG, Xiao-Feng[2], (1) Department of Earth and Space Sciences, University of California Los Angeles, Los Angeles, CA 90095, acrobinson@uh.edu, (2) Institute of Geomechanics, Chinese Academy of Geological Sciences, Beijing, 100081, China

Within the Pamir salient at the western end of the Indo-Asian collision zone, Cenozoic metamorphic rocks are exposed in the fault bounded cores of two antiformal domes in the Central Pamir (the Muskol and Sares antiforms) and the footwall of the Kongur Shan normal fault (Robinson et al., 2004; Schwab et al., 2004). Where dated, these basement rocks record late Oligocene to late Miocene amphibolite facies metamorphism, synchronous with Miocene igneous activity in the Central Pamir. Field observations and previous studies show a lack of Cenozoic shortening in the upper crust of the Northern Pamir, suggesting that crustal thickening associated with Cenozoic metamorphism was largely driven by underthrusting of crustal material. Additionally, footwall rotation along the Kongur Shan normal fault indicates the eastern boundary of the Cenozoic metamorphic rocks, the steeply east-dipping right-lateral Ghez shear zone, has been rotated from an originally sub-horizontal orientation. The shear sense along the sub-horizontal Ghez shear zone would therefore record northward translation of the footwall relative to the hanging wall. We propose a model in which mid- to late-Cenozoic crustal thickening in the Pamir was primarily driven by northward underthrusting and internal thickening of the mid- to lower-crust along a sub-horizontal decollement. Thickening and heating in the hinterland of the underthrust sheet (beneath the Central and Southern Pamir) lead to partial melting in the Miocene. The increase in buoyancy and decrease in strength of the middle and lower crust resulted in extrusion of the Central Pamir gneiss domes, synchronous with continued underthrusting beneath the Northern Pamir and pervasive Miocene igneous activity in the Central Pamir.

92-9 **3:30 PM** Yin, An

CREATING TIBETAN PLATEAU THE TIAN SHAN WAY: LARGE-SCALE OUT-OF-SEQUENCE THRUSTING AS A MECHANISM FOR TIBETAN PLATEAU DEVELOPMENT

YIN, An, MCRIVETTE, Michael, BURGESS, W. Paul, and CHEN, Xuanhua, Department of Earth and Space Sciences, University of California, Los Angeles, CA 90095, yin@ess.ucla.edu

Determining the growth history of the Tibetan plateau is central to understanding the dynamics of Cenozoic Indo-Asian collision. Tectonic models in this regard range from whole-sale uplift to progressive enlargement of the plateau either by continuous northward propagation or stepwise jumping of plateau front. To test these competing hypotheses, we conducted geologic mapping and analyses of satellite images and seismic reflection profiles across the Kunlun Range and the Qaidam basin in central Tibet. Our results indicate that the above models do not adequately explain the geologic history of the Kunlun Range, which has experienced significant out-of-sequence thrusting since the Neogene. Our field observations and reflection profiles from Qaidam basin suggest that Cenozoic tectonics of the Kunlun Range is dominated by south-directed back-thrusting initiated in the middle or late Miocene. The presence of thick Paleogene strata (7-2 km) on both sides of the Kunlun and the observation that the Qilian Shan-Nan Shan thrust (QNTB) had started developing since ~ 50 Ma require the existence of a single large basin trapped between the elevated southern Tibetan plateau (Lhasa block) and the high region of the QNTB, with a basin width of 600-800 km in the north-south direc-

temporally. The deposits and landforms in the ridged-drift in some ways resemble the younger kettle-moraine area of southeastern Wisconsin (Carlson et al., 2005), but on a smaller scale.

91-9 **3:45 PM** Arends, Heather Emma

DES MOINES LOBE TILL COMPOSITION AND TEXTURE AS AN INDICATOR OF FLOW DYNAMICS

ARENDS, Heather Emma, Univ Minnesota - Duluth, Dept Geological Sciences, Duluth, MN 55812-2496, heather.arends@dnr.state.mn.us and MOOERS, Howard, Univ Minnesota - Duluth, Dept Geological Sciences, Duluth, MN 55812-2496

The lack of lithological and textural variation of the Des Moines Lobe (DML) till exposed in southwestern Minnesota indicates decoupling of basal ice from its sediment bed. DML till contains an abundance of Pierre Shale, which can be used as a distinctive indicator lithology. From the source of the shale in Manitoba to the field area in western Minnesota, the DML till develops its textural and lithologic composition. As the DML lobe continues to advance into Minnesota, the topographic highs of the Coteau des Prairies and the Alexandria Moraine confine the lobe. Within this topographic confinement, the till exhibits no systematic change in either lithologic or textural composition along the central axis of the lobe, despite increasing transport distances of greater than 150 km. This observation indicates the till is not being diluted by the progressive incorporation of underlying material nor comminuted by englacial or subglacial shearing. However, the shale content and texture of the till deposited along the margins of the DML rapidly changes as the ice advances over mild adverse slopes indicating both dilution and comminution rapidly occur. Consolidation tests of the DML till (Hooyer and Iverson, 2002) suggest that the basal water pressure was near the ice overburden pressure. We test the hypothesis that topographic constraints restrict the flow of basal meltwater along the axis of the lobe, yielding higher water pressures to decouple the ice from the bed and effectively decreasing shear strain within the bed. Along the DML margins, where the ice is in contact with the bed, basal processes of comminution and dilution operate effectively resulting in a compositionally and texturally variable till.

91-10 **4:00 PM** Lea, Peter D.

SUBGLACIAL MELTWATER CHANNELWAYS IN MID-COAST MAINE

LEA, Peter D., Geology Department, Bowdoin College, 6800 College Station, Brunswick, ME 04011, plea@bowdoin.edu

Subglacial meltwater channelways are an important, if little appreciated, component of landscapes in mid-coast Maine that were inundated by the Laurentide Ice Sheet. Such channelways strongly influence modern drainage patterns, and also provide insight into former ice-flow dynamics. Subglacial meltwater channelways are eroded into the northeast/southwest-striking bedrock, typically as steep-sided, locally overdeepened, southeast-trending divide crossings (e.g., the Androscoggin channelway, and the Chops at Merrymeeting Bay) or as south- to southwest-trending troughs parallel to bedrock strike (e.g., the Kennebec channelway between Augusta and Richmond, and the Thomas Bay-New Meadows channelway which continues off the modern coast).

The 50-km-long Cathance meltwater channelway (CMC), which diverges southwestward from the Kennebec channelway near Gardiner, provides a good example of features associated with channelized subglacial meltwater erosion on a regional scale. From the Kennebec, the CMC rises to a divide comprising numerous dissected bedrock hills, and descends as two parallel bedrock troughs that merge into a broader and shallower trough down flow. The CMC crosses the Androscoggin channelway at a high angle, where it is partially filled by a buried, southwest-trending sand-and-gravel aquifer, and continues its rising-and-falling course parallel to the modern coast to Freeport.

Modeling of subglacial hydraulic heads and resulting meltwater flow patterns for simplified (planar) ice sheets of varied slope angle and direction indicate that southeast- and some south- to southwest-trending subglacial meltwater channelways likely formed under south-southeastward ice flow, consistent with the bulk of regional striae data. In contrast, formation of the CMC requires ice flow to the southwest and/or sufficient subglacial discharge to overwhelm the capacity of the Kennebec and Androscoggin channelways. The age of formation of the various channelways is unknown and may include more than one glacial cycle.

91-11 **4:15 PM** Smith, Jacqueline A.

COSMOGENIC DATING OF MORAINES AT THE SOUTHERN END OF THE CORDILLERA BLANCA, PERU

SMITH, Jacqueline A., Physical & Biological Sciences, The College of Saint Rose, 432 Western Avenue, Albany, NY 12203, smithj@strose.edu and RODBELL, Donald T., Geology, Union College, F. W. Olin Center, Schenectady, NY 12308-3107

Preservation of long glacial sequences that can be dated with cosmogenic isotopes requires exceptional circumstances, including limited ice expansion at the last glacial maximum (LGM; marine isotope stage 3 or 2) relative to pre-LGM glaciations, low boulder-erosion rates, and sufficient space for ice to spread out and form moraines that are not superimposed. These conditions were met in the Junin region of the Peruvian Andes (S 11°, W 76°), where pre-LGM piedmont glaciers flowed onto the high-altitude Junin Plain repeatedly over the past half million years, producing a sequence of moraines (JQS 20: 735-758). We believe we have found another example of old moraines preserved on a high-altitude plateau in the Peruvian Andes. The Nevado Jeulla Rajo massif (S 10°00', W 77°16') marks the southern end of the Cordillera Blanca and the Callejon de Huayllas valley in the central Peruvian Andes. Laguna Conococha and the Conococha Plain (approx. 4050 masl) border the western side of the massif, which has peak altitudes of approx. 5600 meters above sea level (masl) and currently hosts a number of small glaciers. Several sets of large lateral moraines extend onto the Conococha Plain from the Jeullesh Valley. Multiple smaller end moraines lie upvalley, closer to the active ice margin. The largest pair of lateral moraines cross-cuts another pair from Jeullesh Valley and a pair from Quenua Ragra Valley to the east. Field observations of boulder weathering (mainly granodiorite and quartzite boulders) and moraine morphology suggest that these large lateral moraines all predate the LGM and that the sampled end moraine marks the LGM ice limit in the Jeullesh Valley. We have dated boulders on the three pairs of large lateral moraines and on the lowermost end moraine loop in Jeullesh Valley using surface exposure dating with cosmogenic isotopes (^{10}Be).

SESSION NO. 92, 1:30 PM
Monday, 23 October 2006
Tectonics I
Pennsylvania Convention Center, 108-A

92-1 **1:30 PM** Gutierrez-Alonso, Gabriel

SELF-SUBDUCTION OF A GLOBAL PLATE – THE BEGINNING OF PANGEA'S END?

GUTIERREZ-ALONSO, Gabriel, Departamento de Geologia, Universidad de Salamanca, Salamanca, 37008, Spain, gabi@usal.es, FERNANDEZ-SUAREZ, Javier, Departmento de Petrologia y Geoquimica, Universidad Complutense, Madrid, 28040, WEIL, Arlo, Department of Geology, Bryn Mawr College, Bryn Mawr, PA 19010, MURPHY, J. Brendan, Dept. of Earth Sciences, St. Francis Xavier University, Antigonish, NS B2G2W5, Canada, NANCE, R. Damian, Geological Sciences, Ohio Univ, Athens, OH 45701, CORFÚ, Fernando, Institute of Geology, University of Oslo, Blindern, Postboks 1047, Oslo, N-0316, Norway, and JOHNSTON, Stephen T., Victoria, BC V8W 3P2, Canada

The supercontinent cycles of continental lithosphere amalgamation followed by supercontinent demise and dispersal is one of the most fundamental topics in Earth history. Particularly abundant are the studies regarding Pangea, the most recent supercontinent, which progressively amalgamated over a period of time ranging from Carboniferous (ca. 320) to Upper Triassic (ca. 200 Ma). Although much is known of the different processes that took place during the accretion and dispersal of Pangea a number of key issues regarding the cause or causes for the initiation of its dispersal that are not fully understood. In particular, the causes of the initial stages of Pangea dispersal, prior to the onset of continental drifting in the early Jurassic, have been widely debated and are grouped into two main issues: post "Variscan-Alleghenian" orogenic collapse and the broad effects of a mantle superplume. However, both arguments fail to fully explain three of the main features that characterize the initiation of the Pangea breakup and dispersal: 1) the cause of the huge thermal event that affected most of the core of Pangea, accompanied by the genesis of radial rift basins; 2) the cause of the opening of the Neotethys ocean and the coeval genesis of the Cimmerian ribbon continent; and 3) the genesis of a key lithosphere-scale orocline, the Cantabrian or Iberian-Armorican Arc, located in the center of the supercontinent. Using a simple plate tectonic model that accounts for the geodynamic linkages between the features we propose a kinematic evolution to explain the origin of Pangean dispersal. We show that, under appropriate conditions, the oceanic part of a global plate (Paleotethys ocean as part of the Pangean global plate) can subduct under the same global plate, leading to a rapid change in its stress-strain configuration on a continental lithospheric scale. This scenario led to a radically different stress-strain configuration during the Upper Pennsylvanian-Early Permian that initiated processes that ultimately led to the breakup of Pangea. The process thus initiated was arrested when the Pangean global plate broke into two plates during the opening of the Neotethys ocean.

92-2 **1:45 PM** Kylander-Clark, Andrew

U-PB TITANITE AGES OF DECOMPRESSION MELTING DURING EXHUMATION OF THE WESTERN GNEISS REGION ULTRAHIGH-PRESSURE TERRANE

KYLANDER-CLARK, Andrew[1], HACKER, Brad[1], MATTINSON, Jim[2], and RIOUX, Matt[2], (1) Geological Sciences, UC, Santa Barbara, Department of Geological Sciences, UC Santa Barbara—Building 526, Santa Barbara, CA 93106-9630, akylander@umail.ucsb.edu, (2) Department of Geological Sciences, Univ of California at Santa Barbara, Santa Barbara, CA 93106

The Western Gneiss Region of Norway includes one of Earth's giant ultrahigh-pressure (UHP) terranes. Understanding the subduction and exhumation of this >60,000 km^2 area is relevant to a range of processes, including collisional orogenesis, reworking of the continents, and the global geochemical cycle. Important aspects that remain unanswered include the spatial and temporal variations in the rate of exhumation and the extent of phase transformation-induced reworking during exhumation. To address this issue we have determined the ages of titanites from leucosomes within Western Gneiss Region orthogneiss. Textures of large (up to 1 cm) euhedral titanites imply growth during melt-induced recrystallization. Two of these titanites—one from a high-pressure region, the other from an ultrahigh-pressure region—yield identical concordant ^{238}U-^{206}Pb ages of 390.2 ± 0.8 Ma; slightly older titanite ages characterize much of the Western Gneiss Region (Tucker et al., 1990). This decompression-related melting occurred ~11 m.y. after peak metamorphism at 401.6 ± 1.6 Ma (Carswell et al., 2003). In contrast to the uniformity in titanite ages, muscovite cooling ages show a pronounced gradient from 399 Ma near the foreland to 375 Ma in the UHP domain (Root et al., 2005; Walsh et al., in press). These differences—coeval closure of titanite and diachronous closure of muscovite—argue for kinematically and geometrically complex exhumation wherein the UHP body reached Moho depths en masse but was then borne up into the shallow crust via successive east-to-west unroofing.

92-3 **2:00 PM** Mazzoli, Stefano

MODES OF TECTONIC ACCRETION AND RECENT (< 10 MA) TECTONIC EXHUMATION IN THE SOUTHERN APENNINES FOLD AND THRUST BELT (ITALY): STRUCTURAL AND THERMOCHRONOLOGICAL CONSTRAINTS

MAZZOLI, Stefano[1], ALDEGA, Luca[2], CORRADO, Sveva[2], D'ERRICO, Marco[1], INVERNIZZI, Chiara[3], SHINER, Peter[4], and ZATTIN, Massimiliano[5], (1) Dipartimento di Scienze della Terra, Università di Napoli 'Federico II', Largo San Marcellino 10, Naples, 80138, Italy, stefano.mazzoli@unina.it, (2) Dipartimento di Scienze Geologiche, Università degli Studi 'Roma Tre', Largo San Leonardo Murialdo 1, Rome, 00146, Italy, (3) Dipartimento Scienze della Terra, Università di Camerino, Via Gentile III da Varano, Camerino (MC), 62032, Italy, (4) Shell Italia E & P, Via Due Macelli 66, Rome, 00187, Italy, (5) Dipartimento Scienze Geologiche e Ambientali, Università di Bologna, Via Zamboni, Bologna, 40126, Italy

Integrated structural, clay mineralogy, vitrinite reflectance, fluid inclusion and apatite fission track studies point out exhumation of sedimentary units from depths locally in excess of 5 km during the last 10 Ma in the southern Apennines. Here, Early Miocene docking of the convergent continental margins did not result readily in full continental collision; subduction of the leading edge of the thinned Adria continental margin is testified by the occurrence of HP-LT metasediments and was accompanied by NE-directed, detachment-dominated thrusting of cover rocks. These include both Mesozoic-Tertiary carbonate platform and pelagic (Lagonegro Basin) successions, together with unconformable Miocene siliciclastics. Collectively these

MONDAY

THE GEOLOGICAL SOCIETY OF AMERICA

Abstracts with Programs Vol. 38, No. 7 2006 GSA Annual Meeting ISSN 0016-7592

THE GEOLOGICAL SOCIETY OF AMERICA

GSA Annual Meeting & Exposition

The Pursuit of Science

Building on a Foundation of Discovery

Abstracts with Programs