50-9 **3:00 PM** Carr, Sharon D.

CRETACEOUS - EARLY TERTIARY TECTONIC EVOLUTION OF THE VALHALLA COMPLEX, SOUTHERN OMINECA BELT, BRITISH COLUMBIA

CARR, Sharon D., Earth Sciences, Carleton Univ, 1125 Colonel By Dr, Ottawa, ON K1S 5B6, Canada, scarr@ccs.carleton.ca and SIMONY, Philip S., Department of Geology and Geophysics, Univ of Calgary, Calgary, AB T2N 1N4, Canada

The 20 x 80 km Valhalla complex comprises sheets of orthogneiss and amphibolite-facies metasedimentary rocks that were intruded by Paleocene - Eocene lacoliths. The sheets are gently domed, and are disposed in three culminations; the Valhalla dome, Passmore dome and the Southern Valhalla complex. The Valhalla complex constitutes the lower plate of the Valkyr - Slocan -Champion Lakes extensional shear zone system. Deeper levels in the complex are characterized by structures that were mainly formed during Cretaceous to Paleocene crustal shortening and thickening of the orogen. The predominant structure is a diachronous transposition foliation. It is overprinted in places by polyphase folding and zones of intense strain. Geochronological and structural studies constrain the spatial distribution and timing of shear zones and transposition foliation. In the Southern Valhalla complex, displacement on Early Tertiary extensional faults is <5 km and a downward transition from Middle Jurassic upper plate structures into Cretaceous transposition foliation is exposed without a significant tectonic break. Foliations that range in age over 120 m.y. are all statistically parallel.

Where emplacement of magmas or melt is localized at particular structural levels, deformation may have been strongly thermally controlled and confined to particular levels. It is clear that the presence and orientation of pre-existing structures has served to influence disposition of magma and guide younger structures. In Valhalla and Passmore domes the peak of metamorphism and anatexis at conditions of ~ 800 oC and 8 kbar occurred at ca. 70 Ma and was concomitant with thrusting on the Gwillim Creek shear zone. Cretaceous high-grade deformation was followed by the intrusion of Late Paleocene and Early Eocene granite and pegmatite, localization of extensional shear zones along the upper margin of the zone of intrusion, and exhumation and cooling of the complex. With the exception of late steep brittle faults and late dykes, all of the rocks and structures in Valhalla complex, as well as structures as young as the 58 Ma Valkyr shear zone are arched; therefore, the doming is a young feature that occurred in the Early Tertiary. Doming may be related in part to motion on structures beneath the Valhalla complex that accommodated the last stage of Early Tertiary shortening in the Foreland Belt.

50-10 **3:15 PM** Glombick, Paul M.

THE ROLE OF A MELT-RICH MIDDLE CRUST LAYER IN CORE COMPLEX FORMATION: EVIDENCE FROM THE SHUSWAP METAMORPHIC COMPLEX, SOUTH-CENTRAL BRITISH COLUMBIA

GLOMBICK, Paul M.[1], THOMPSON, Robert I.[2], and ERDMER, Philippe[1], (1) Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB T6G 2E3, Canada, glombick@ualberta.ca, (2) Geological Survey of Canada, Pacific Geoscience Center, P.O. Box 6000, 9860 West Saanich Road, Sidney, BC V8L 4B2, Canada

The Shuswap metamorphic complex underwent extension during the early Tertiary, resulting in the exhumation of high-grade, mid-crustal rocks and the formation of gneiss domes. Rocks within the study area may be divided into three crustal levels based on structural style, metamorphic grade, and lithostratigraphy. In the region between Vernon and Nakusp all three levels are exposed, providing the ideal opportunity to study the relationship between extension and gneiss dome development in a Cordilleran metamorphic core complex.

Rocks of the lowest level are exposed in the Monashee complex, which is comprised of two domes of Early Proterozoic paragneiss and orthogneiss, mantled unconformably by paragneiss of the middle level. Middle level rocks, of Proterozoic to Mesozoic age, display a marked contrast in structural style compared with the lower level. They are characterised by gently-dipping foliation, a consistently oriented stretching lineation, and abundant Paleocene to Eocene syn- to post-kinematic granitic material. Upper level rocks record much lower peak metamorphic conditions and exhibit more upright structures of mid-Jurassic age. The upper/middle level transition is characterised by a several kilometre-thick zone with a steep but continuous metamorphic gradient and a penetrative stretching lineation. Detachment faults and steep normal faults, where present, modify this transition. Pressure and temperature differences between the middle and upper levels indicate that rocks apparently separated by a depth of 10 to 15 kilometres during the late Cretaceous are presently juxtaposed across this 2 to 3 kilometre-thick zone.

We propose a model for extension in the Shuswap metamorphic complex whereby exhumation occurred primarily through removal of ductile, melt-laden mid-crustal rocks from beneath the stiff upper crust by extrusion in response to lateral pressure gradients. Ductile flow of mid-crustal rocks may be of greater importance in the formation of Cordilleran metamorphic core complexes and gneiss domes than has been previously recognised.

50-11 **3:30 PM** Edwards, M.A.

A GUIDE TO DOME IMPROVEMENT, LESSON 1: IS YOUR DOME BUILT ON GRANITE OR GNEISS?

EDWARDS, M.A., Structural Geology and Tectonics, Univ of Vienna, Institut fuer Geologie, Althanstrasse 14, Vienna, A-1090, Austria, medwards@gmx.net, KIDD, William S.F., Dept of Earth and Atmospheric Sciences, Univ at Albany, Albany, NY 12222, and SCHNEIDER, D.A., Dept. of Earth Sciences, Ohio Univ, Athens, Athens, OH 13244

Domes of high-grade metamorphic and plutonic rocks commonly occur in orogenic cores. This paper uses the Himalayan orogen and considers two regions where young "gneiss domes" are well-developed; the syntaxes (the western & eastern tips of the Himalayan arc) and the central & eastern Himalaya (Southern Tibet, structurally above Nepal, Sikkim and Bhutan). These areas suggest that there may be two alternative or end member types of domes; (1) those "cored" or formed mostly by granitic rocks that are associated with extrusive flow of a partially molten middle crust, and (2) those formed by polymetamorphism and extensive reworking & exhumation of the subducted Indian cover & basement.

In the central Himalaya, domes typically consist of large volumes of granitic rock that mostly (but not always, e.g., Kangmar) has crystallisation ages that are young with respect to the collision. On the eastern flank of the Yadong-Gulu Rift System, numerous leucogranite domes of a few 100 sq. km (e.g., Karo La, Kangmar, & Mangda Kangri) poke through a thin (<15 km thickness revealed by INDEPTH profiling data) cover of Tethyan phyllite that acted as the principal thin-skinned decollement during early Himalayan convergence. This layer of non-coaxially strained phyllite has acted as a partial thermal sink that impeded granite ascent while at the same time forming the upper margin of the slab (or "channel") through which the partially molten middle crust is being extruded southwards. The domes are a minor by-product of the slab extrusion and there is no major re-working of basement. It is unlikely that these domes would be recognisable in the roots of the future fossil Himalayan orogen.

In the syntaxial regions of the Himalaya (Namche Barwa & Nanga Parbat) are polymetamorphic terranes involving very young, multiple re-working of older Himalayan- to Proterozoic-aged crust. In the most recently active portions of the syntaxes, relative uplift of the dome core is via steep crustal scale shear zones. There is no extensive partial melt body; plutonism and migmatization was via localised and protracted multi-stage addition. The Dome architecture seems to be central (!) to the localised late orogenic activity and is likely a modern analogue for gneiss domes found in ancient orogens (i.e. these domes would be recognisable in the future fossil Himalaya).

SESSION NO. 51, 8:00 AM

Monday, October 28, 2002

Archaeological Geology (Posters)

Colorado Convention Center, Exhibit Hall

51-1 **BTH 1** Heinzel, Chad

RULING THE ROOST OF WESTERN SICILY, 1200 TO 100 BC, HUMAN DEVELOPMENT VERSUS AN EVOLVING LANDSCAPE

HEINZEL, Chad[1], KOLB, Michael[2], POWELL, Ross[1], STRAVERS, Jay[1], and KONEN, Michael E.[3], (1) Dept. of Geological and Environmental Sciences, Northern Illinois Univ, DeKalb, IL 60115, cheinzel@geol.niu.edu, (2) Dept. of Anthropology, Northern Illinois Univ, DeKalb, IL 60115, (3) Geography, Northern Illinois Univ, 212 Davis Hall, DeKalb, IL 60115

This work integrates geological and archaeological techniques to answer significant historical/pre-historical questions regarding the anthropogenic and geomorphic Holocene development of western Sicily. The Sicilian Scandinavian Archaeological Project has identified substantial diagnostic artifact concentrations, settlement structures, and tombs of the Late Bronze (1200 BC), Early Iron (1100 BC), and Roman Ages (100 BC) within the Salemi study region through extensive and intensive surveys followed by excavations. This extensive anthropogenic record is set within an intriguing geologic setting. Geologic investigations have identified a well-preserved Late Pleistocene and Holocene alluvial stratigraphic record. Massive, 3 to 30 meters, Pleistocene alluvial debris fans dominate the upper and lower slopes of Montange Grande. Fan sedimentation appears to have been relatively cyclical with individual depositional layers averaging 25 cm in thickness. Paleosol development is evident from laterally extensive horizonation within fan stratigraphy. Late Bronze Age, 1200 BC, fan reactivation is represented by cut and fill channel structures containing diagnostic ceramics, equine skeletal fragments, and terrestrial mullusc shells. The study area's main fluvial channel, the Fasso di Collura, contains a diverse stratigraphic record. Stratigraphy varies from limestone gravel (Montange Grande, North) to sandstone cobbles and boulders (Monte Polizzo, South). Twenty-five described fluvial stratigraphic sections, 1 meter wide by 3 meters deep, from the main channel indicates two periods of increased sedimentation. Lower beds (0 to 1.8 m) included inter-bedded layers of sandstone cobbles/boulders and reddish brown silt/mud containing diagnostic Late Bronze and Early Iron Age ceramics. The upper beds are generally more fine-grained and contain a mix of limestone and sandstone gravel with a matrix of sand and silt (7.5 YR 4/3). At least one fluvial section contains a paleosol dating to the early Roman occupation, 100 BC, of the study area.

51-2 **BTH 2** Nicoll, Kathleen

GEOMORPHIC SETTING AND PREHISTORIC OCCUPATION OF THE SOUTHERN CUYAHOGA RIVER VALLEY, NE OHIO: OBSERVATIONS FROM A GIS DATABASE

BAUER, Andrew, Department of Anthropology, Univ of Chicago, 1226 E. 59th St, Chicago, IL 60637, bauer@uchicago.edu, NICOLL, Kathleen, School of Geography and the Environment, University of Oxford, Mansfield Road, Oxford, OX1 3TB, England, Kathleen.Nicoll@alumnae.brynmawr.edu, MATNEY, Timothy, Department of Classical Studies, Anthropology, and Archaeology, The University of Akron, Akron, OH 44325-1910, and PARK, Lisa, Department of Geology, The Univ of Akron, Akron, OH 44325-4101

The prehistoric record of the southern Cuyahoga River Valley (hereafter, CRV) in northeastern Ohio is grossly underrepresented in printed reports, although many sites have been registered at the State of Ohio Historic Preservation Office. We have reviewed and compiled these site locations in a Geographic Information Systems (GIS) database to examine the distribution of 79 archaeological sites in the study region, located north of the city of Akron and south of the town of Peninsula. Using digitized soil data to generate a geomorphic data layer, we assessed the spatial and temporal distribution of archaeological sites among the major documented landscape components in the southern CRV. As a foundation for better understanding the records of human activity within the region, our GIS demonstrates some associations between geomorphic setting and site temporality. Paleoindian sites only occur on Wisconsin cut terraces and in upland interfluve settings. Archaic period sites occur most frequently on Wisconsin cut terraces and interfluve settings. Woodland period and Historic sites occur in most geomorphic settings. The quality of inferences drawn from our GIS analyses reflects the limitations of our initial input data, particularly in regard to positional errors. To quantify and rectify these kinds of errors requires extensive fieldwork and site-specific interpretations of depositional environments and associated cultural materials. Modeling the CRV landscape at a regional scale can help forecast what surveys can expect to find and where they will be successful, thereby allowing geoarchaeologists to develop more efficient (e.g. stratified sampling) and more successful (e.g. removing sediment overburden) surveys.

51-3 **BTH 3** Honeychurch, W.

GEOMORPHIC CONTROLS ON THE DISTRIBUTION OF ARCHEOLOGICAL SITES IN EGIIN GOL, NORTHERN MONGOLIA

JACKSON, Meghan, Earth and Environmental Science Dept, New Mexico Tech, 801 Leroy Place, Socorro, NM 87801, mleajaxon@nmt.edu, HARRISON, J.B.J., Dept. of Earth and Environmental Science, New Mexico Tech, Socorro, NM 87801, and HONEYCHURCH, W., Museum of Anthropology, Univ of Michigan, 4009 University Museums Building, 1109 Geddes Ave, Ann Arbor, MI 48105, honeychu@umich.edu

Geomorphic processes influence the apparent distribution of archaeological sites in two ways: a) by controlling the distribution of resources, either food or shelter and b) by influencing the preservation of sites. An understanding of the timing and rate of the development of land forms provides a basis for stratifying a landscape and allows identification of areas of higher probability for containing archaeological sites. This becomes particularly important when archaeological surveys have to be undertaken in a limited time frame.

The Egiin Gol river is a tributary of the Selenge River in northern Mongolia. A proposal to build a hydroelectric dam on this river in 1990 resulted in an intensive survey to identify all archaeological sites in the valley which would potentially be impacted by this project. The survey showed evidence for habitation in the Egiin Gol from circa 30,000 yrs BP to the present. Concurrent with the archaeological survey, a detailed map was made of the land forms in part

Yucca Mountain (YM). An initial screening was conducted of 94 faults within 100 km of YM with known or suspected Quaternary activity. Near the site, ten local faults within 10 km of YM, and two major faults within 25 km of YM, were selected for detailed studies. These consisted of: (a) field mapping along surface traces to document evidence for or against Quaternary surface displacements, and (b) excavation of about 50 trenches across faults suspected of Quaternary movement. Stratigraphy and soils exposed in trench walls were mapped in detail to identify the presence/absence, number, size, and stratigraphic context of displacements in bedrock and/or surficial deposits. Geochronologic control on displacement ages were provided by (a) thermoluminescence (TL) dates on fine-grained deposits, (b) U-series dates on secondary pedogenic carbonate, and (c) geochemical correlation of basaltic ash layers to nearby dated eruptive centers. Evidence for 1-7 co-seismic surface ruptures was found on all but one of the 12 faults studied in detail. Surface displacements occurred during the middle to late Quaternary and ranged in size from 5 cm to 350 cm per event. The timing constraints provide estimates of recurrence intervals from 10 ka to >100 ka with slip rates of 0.001 to 0.05 mm/yr. Fault combinations and distributed rupture scenarios were evaluated, as well as a possible temporal linkage between fault displacements and the 80 ka Lathrop Wells volcanic eruption. The Quaternary fault characteristics of the rupture length, per-event displacement, slip rate, and recurrence interval, along with fault geometry, were used to characterize the probabilistic and deterministic seismic hazards at Yucca Mountain.

49-7 **2:45 PM** Wong, Ivan G.

EARTHQUAKE HAZARDS AT YUCCA MOUNTAIN, NEVADA

WONG, Ivan G., Seismic Hazards Group, URS Corporation, 500 12th St, Suite 200, Oakland, CA 94607, ivan_wong@urscorp.com, STEPP, J.C., Blanco, TX, WHITNEY, J., USGS, Denver, CO, QUITTMEYER, R., ISSI, Las Vegas, NV, ABRAHAMSON, N., Piedmont, CA, COPPERSMITH, K., Walnut Creek, CA, YOUNGS, R., Geomatrix Consultants, Oakland, CA, TORO, G., Risk Engineering, Acton, MA, SULLIVAN, T., DOE, Las Vegas, NV, and SAVY, J., LLNL, Livermore, CA

Probabilistic seismic hazard analyses (PSHA) were performed to evaluate the ground shaking and fault displacement hazards at the potential geologic repository for spent nuclear fuel and high-level radioactive waste at Yucca Mountain. The PSHA results are being used both for developing the seismic design of preclosure facilities and for evaluating the postclosure performance of the repository. The PSHA inputs were provided by 6 teams of 3 experts each for seismic source and fault displacement characterization (SSC) and by 7 individual experts for ground motion (GM) characterization.

Approximately 20 faults within ~20 km of the site and up to 36 regional faults (out to ~100 km) were included in the SSC experts' characterizations. The most significant local faults included the Bow Ridge, Paintbrush Canyon, Solitario Canyon, and Stagecoach Road faults, which bound major crustal blocks at Yucca Mountain. These faults are characterized by low slip rates of approximately 0.001–0.05 mm/yr and recurrence intervals of 10,000 to more than 100,000 years. The experts' maximum magnitudes (Mmax) ranged from **M** 5.7–6.8. The most significant regional faults were the Death Valley and Furnace Creek faults with slip rates of 2.5–8.0 mm/yr and Mmax of **M** 7.0–7.5. Areal source zones were also characterized to account for background seismicity not associated with known faults and faults not specifically characterized by the experts; their parameters were derived from the historical seismicity record. Mmax in the range of **M** 6.0–7.5 were assigned to these zones. These Mmax were reduced to **M** 5.0–6.6 in the site vicinity because of the detailed characterization of faulting

The GM experts estimated ground motions and uncertainties for a matrix of magnitudes, source-to-site distances, and faulting styles based on empirical data and numerical ground motion modeling. Attenuation relationships were derived from regressing on these ground motions. Based on the experts' input, the probabilistic hazard for ground shaking was calculated. Several approaches to characterize fault displacement potential were also developed by the SSC experts based primarily on paleoseismic observations of faulting at the site. Based on the experts' input, the probabilistic hazard for fault displacement was calculated at several points near and within the repository footprint.

49-8 **3:00 PM** Deemer, Danielle L.

TECTONIC HISTORY OF MAJOR FAULTS IN THE YUCCA MOUNTAIN REGION: POTENTIAL PATHWAYS FOR FLUID MIGRATION

ANDERSON, Thomas H., DEEMER, Danielle L., and VANDER SCHRIER, Ann L., Geology and Planetary Science, Univ of Pittsburgh, 200 SRCC, Pittsburgh, PA 15260, dldst59@pitt.edu

Kinematic analysis of regional fault systems and field studies (mainly west of Mercury, NV) provide insight into the tectonic history of Yucca Mountain. Our results support the interpretation of the Yucca Mountain region as a pull-apart basin filled with volcanic units erupted through thinned crust. The boundaries of the southern part of the pull-apart basin coincide with major faults (Kawich Greenwater rift or Gravity fault, Highway 95/Carrara, and Bare Mountain). These major fault structures may influence and possibly control the transmission of water from the proposed repository into Amargosa Valley. Tens of kilometers of right-lateral displacement along the Las Vegas Valley Shear Zone (LVVSZ) were accommodated by formation of a pull-apart basin at a northward releasing step along Forty Mile Wash. East of Forty Mile Wash, the trace of the LVVSZ trends westerly (roughly between Lathrop Wells and Mercury) probably along a pre-existing structure. Upright folds with local vertical limbs in layers of the rocks of Pavits Spring (approximately 17 to 14 Ma) south of Little Skull Mountain record transpression along the constraining bend. Tuff of the Crater Flat Group (approximately 14 Ma) that directly overlies the folded beds of Pavits Spring records eruption during deformation. Gentle folds and irregular bed geometries that have been mapped in units as young as the Timber Mountain Group are evidence that contraction continued with volcanism until 10 Ma. Contraction recorded by folds is not evident in units younger than 10 Ma suggesting cessation of transpression related to strike-slip movement along the LVVSZ. Paleozoic formations comprising the floor of the Tertiary basin were deformed concurrently as shown by steep bedding, brecciation, detachments and thrusts. Subsequent development of north-striking normal faults commonly linked by northwest-striking right-lateral strike-slip faults (e.g., Yucca Wash; Sever Wash) and complementary northeast-striking left-lateral strike-slip faults (e.g., Mine Mountain; Rock Valley) records the transition to pure shear with local north-south contraction. Normal faults at releasing steps along the Rock Valley Fault that break across west-trending transpressional folds in the Specter Range reveal the relative ages of simple and pure shear deformation.

SESSION NO. 50, 1:00 PM

Sunday, October 27, 2002

T124. Thermal and Mechanical Significance of Gneiss Domes in the Evolution of Orogens (*GSA Structural Geology and Tectonics Division, Mineralogical Society of America*)

Colorado Convention Center, C205

50-1 **1:00 PM** Brown, Michael

CONTROLS ON GNEISS DOME FORMATION: CHICKENS, EGGS AND RED HERRINGS

BROWN, Michael[1], JOHNSON, Tim[1], MARCHILDON, Nathalie[1], and SOLAR, Gary S.[2], (1) Laboratory for Crustal Petrology, Univ of Maryland, Department of Geology, College Park, MD 20742-4211, mbrown@geol.umd.edu, (2) Department of Earth Sciences, SUNY College at Buffalo, 1300 Elmwood Avenue, Buffalo, NY 14222

We consider surficial, tectonic and petrologic controls on gneiss dome formation, using examples from Pacific (accretionary)-type (Cadomian, N. Brittany, France) and collisional-type (Acadian, NH-ME, USA; Variscan, S. Brittany, France) orogens. Controls may include: erosion; lithosphere thinning/delamination/slab breakoff; buoyancy (intracrustal diapirism/escape in subduction zone roll-back); and, melting (volatile phase present and dehydration melting, volume change, rheology, etc.).

Critical to answering the question "Why do gneiss domes form?" is isolating red herrings and distinguishing chickens from eggs. P-T paths are rarely diagnostic of process, although T-t paths may discriminate exhumation mechanisms. Most gneiss domes record evidence of clockwise P-T-t paths. In some examples an erosion-controlled P-T segment may be followed by a near-isothermal decompression segment. This suggests tectonic control, such as a change from contraction to extension, or intracrustal diapirism. Increased buoyancy during melting could initiate diapirism, but this may be a red herring if tectonic controls do not allow the potential of reduced buoyancy to be realized (i.e. effects due to buoyancy are a passive response). Decompression by solid-state diapirism across the Ms-dehydration melting field will involve increased buoyancy (commonly 10-30 vol. % melt), which will enhance diapiric ascent, but this is unlikely to be a trigger for exhumation if melt is retained in the diapir. However, without diapirism, decompression melting can only occur after thinning or exhumation has begun, thus it cannot be a trigger for exhumation. In the anatectic zone, decompression melting is limited because melt mode isopleths are nearly isothermal, except close to the solidus. Thus, decompression melting also may be a red herring. Which of melting or decompression is chicken or egg is a matter of prejudice and may even be moot if dome formation is controlled by other factors. Erosion and/or tectonics (extension or collapse) may be more likely triggers for dome formation, and may even be required. Further, a large contrast in rheology strongly partitions behavior between upper and middle-lower crust, promoting detachment faulting and core complex formation; exhumation may be facilitated by softening associated with melt.

50-2 **1:15 PM** Whitney, Donna L.

GNEISS DOMES AND OROGENY

WHITNEY, Donna L. and TEYSSIER, Christian, Geology & Geophysics, Univ of Minnesota, Minneapolis, MN 55455, dwhitney@umn.edu

Many high-grade metamorphic terranes, including gneiss domes, record clockwise P-T-t paths, with segments of near-isothermal decompression indicating that rocks ascended from >25-30 km to shallow crustal levels (10 km) without significant cooling. These P-T paths cross dehydration melting solidi, producing melt once decompression has initiated. The correspondence of the near-isothermal decompression segment of the path with mica dehydration melting suggests a dynamic relationship between decompression and partial melting. In exhumed orogens, the signature of the rapid ascent of partially molten crust is a gneiss dome cored by migmatite and/or granitoids. Gneiss domes represent partially molten diapirs emplaced sufficiently high in the crust that they freeze and retain their domal shape.

Decompression, partial melting, and generation of gneiss domes may be driven by erosion if the erosion is extremely rapid and localized, such as in orogenic syntaxes (Nanga Parbat, Namche Barwa) or narrow, wrench-dominated orogens (Red River shear zone). On a larger scale (Karakorum, Zanskar, northern N. America Cordillera), decompression may be initiated by thinning of thickened crust and/or by solid-state diapirism, and is sustained at high temperature by the relationship between decompression and partial melting. The most efficient mechanism for deep orogenic crust to ascend without cooling is by buoyant rise of partially molten crust, with buoyancy-driven flow coupled with crustal thinning, especially if the upper crust is removed by extension and/or erosion. It is not clear whether the rising migmatite diapir localizes upper crustal extension or whether the removal of upper crust drives the buoyant rise of partially molten crust. It is likely that these processes are coupled because they involve positive feedback between partial melting and decompression.

The large volume of material involved in the vertical transfer of partially molten crust indicates that the formation of gneiss domes is an efficient mechanism for heat advection and intracrustal differentiation. Given the ubiquity of gneiss domes in orogens of various ages and tectonic settings, the diapiric rise of deep orogenic crust is a fundamental process in the thermal, mechanical, and chemical evolution of continents.

50-3 **1:30 PM** Hurtado, J.M.

EXHUMATION OF THE UPPER MUSTANG MASSIF, THAKKHOLA GRABEN, CENTRAL NEPAL HIMALAYA

HURTADO, J.M. Jr, Department of Geological Sciences, Univ of Texas El Paso, El Paso, TX 79968, hurtado@alum.mit.edu, HODGES, K.V., EAPS, MIT, 54-1010 MIT, Cambridge, MA 02139, RAMEZANI, Jahandar, EAPS, MIT, 54-1020, Cambridge, MA 02139, and BOWRING, Samuel A., EAPS, MIT, Cambridge, MA 02139

The Thakkhola graben intersects the South Tibetan fault (STF) system and bounds the Upper Mustang massif (UMM), one of the North Himalayan gneiss domes. The UMM comprises a half-domical mountain range cored by amphibolite-facies metasedimentary rocks and an igneous complex including two plutons, the Mugu and Mustang granites. The eastern margin of the UMM is defined by the main bounding structure of the Thakkhola graben – the Dangardzong fault – so it is clear that development of the graben has greatly affected the exhumational history of the UMM. We report structural and geochronologic data from transects across the

SUNDAY PM

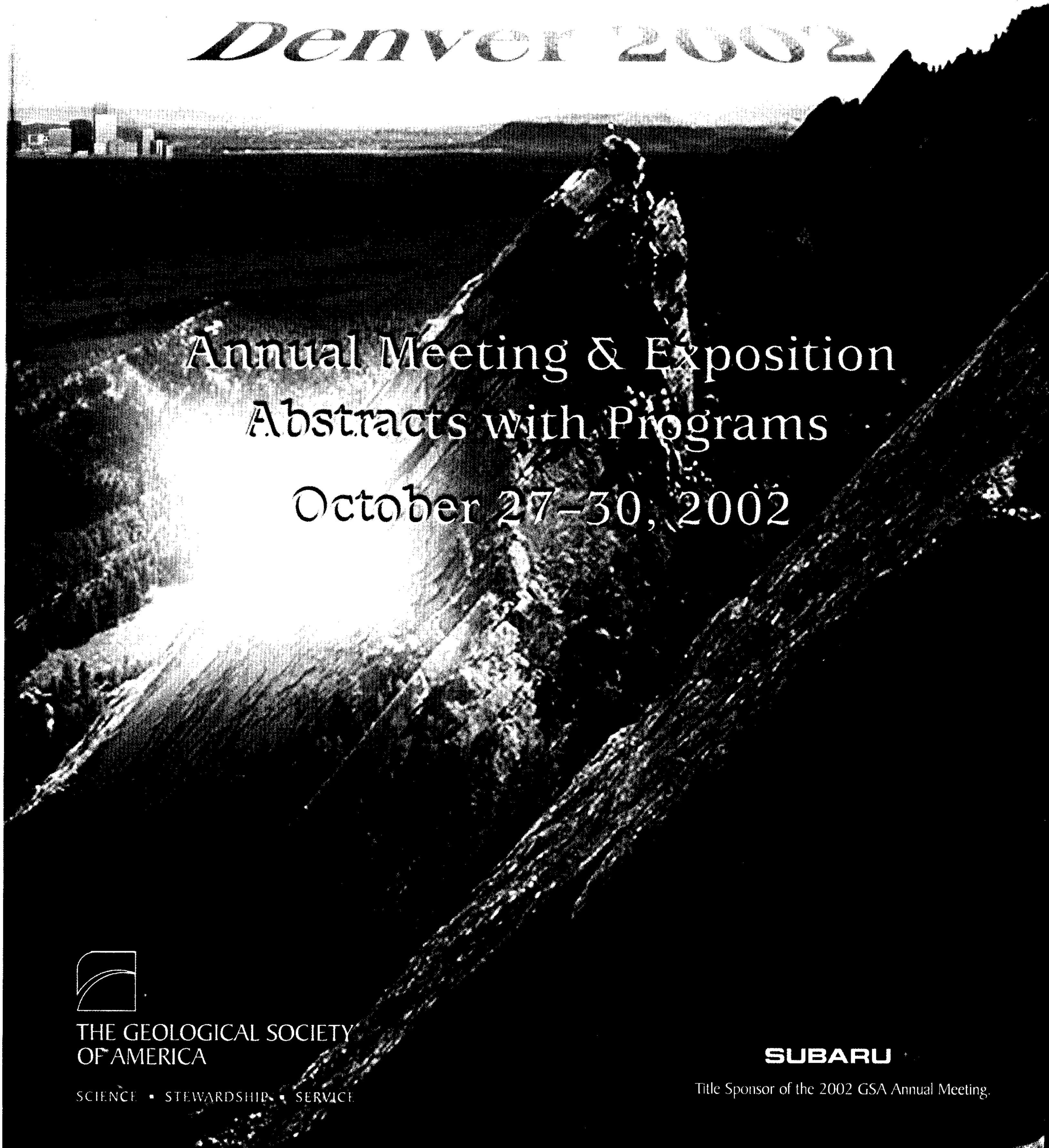
THE GEOLOGICAL SOCIETY OF AMERICA

Abstracts with Programs Vol. 34, No. 6 2002 GSA Annual Meeting ISSN 0016-7592

The Geological Society of America

Science at the Highest Level

Denver 2002



Annual Meeting & Exposition
Abstracts with Programs
October 27–30, 2002

THE GEOLOGICAL SOCIETY OF AMERICA

SCIENCE • STEWARDSHIP • SERVICE

SUBARU

Title Sponsor of the 2002 GSA Annual Meeting.