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Did the Atlantic close and then re-open ? *(Nature, 211, 676-681, 1966)*. John Tuzo Wilson's cyclical event of opening and closing of ocean basins, later found to be a generally applicable, became the "Wilson cycle" *(Dewey, J.F., and Burke, K., Nature, v.249, p.313-316)*.Whilst the cyclical nature appears to be understood what then breaks and consumes the oceans at roughly the same location? Remnant textural anisotropy, structural damage and intra-crystalline water content are means of long-term plate memory (> 500 Myrs). This explains a predetermined breaking point but can these heterogeneities lead to the formation of a lithosphere scale fault allowing the consumption and the opening of oceans? In a self-consistent theory, driven by gravity and thermal-mechanics, only a very narrow parameter range initiates the contraction master fault through feedback of thermal-mechanics and water weakening. We have shown that the water content in olivine must be above 200 ppm H/Si for subduction intiation to be possible *(Science 2001, 294, 578-580)*. Here, we provide a broader context and show that the same criticality exists for the ocean opening phase. We prove that water storage can be the critical ingredient for the whole history of the Wilson cycle. In a worked example we show an exploratory application, to the Atlantic-Iapetus pair. We also look at possible present day seismological observations focusing on the US-Atlantic margin.

T32C-05 1440h

Continents And Mantle Convection: Insulation And Large Scale Flow

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Continents can be seen as passive rafts at the surface of the mantle, while the oceanic lithosphere is continuously recycled through subduction and can be considered as the upper thermal boundary layer for mantle convection. Continents however participate into mantle convection by imposing specific thermal and mechanical boundary conditions. Estimates of mantle heat flow under continental shields can be as low as 10 $mW.m^{-2}$, while the mean heat flow under oceans is 100 $mW.m^{-2}$, indicating that continents are thermal insulators for mantle heat loss. Two-dimensional numerical experiments of mantle convection are carried out to study this thermal blanketing effect. Rigid conductive lids are set on top of an isoviscous fluid. These lids which represent continents induce a special pattern of convection, with a set of hot plumes under the lid feeding a large cellular circulation. We show that continental lithospheres, with an estimated thickness between 100 and 400 km, induce a very strong insulating effect that requires mantle heat flow under continents to be less than 25% of the mean oceanic heat flow. A heat flow scaling is proposed, which gives the mean heat flow on the whole mantle surface, the mean oceanic heat flow and the mantle heat flow under the continent, as a function of the Rayleigh number of the mantle, of the width of the convective cells generated by the continent, and of the continent width, thickness and thermal conductivity. The insulating effect of continents on Earth cooling can be ascribed as much on the fact that a low heat flow is the prevailing boundary condition at the base of the continent, as on the long wavelength pattern of convection induced by the continents. It is shown that mantle heat loss cannot be understood without a full description of the wavelength of mantle flow, and therefore both continents and oceanic lithospheric plates are to be considered.

T32C-06 1455h

Length and Time Scales in Continental Drift

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Nonlinear feedback between continents and the mantle through thermal blanketing has long been surmised as a mechanism for continental drift and Wilson cycles. Paleomagnetism provides ample evidence for large scale (10,000 km) continental motion on time scales of several hundred million years, indicative of large scale mantle circulation. While much has been learned about the interactions between continents and mantle flow from analog and numerical modeling studies in two and three dimensions, a rigorous sensitivity study on the effects of continents in high resolution 3D spherical mantle convection models has yet to be pursued. As a result, a quantitative understanding of the scales of continental motion as they relate to relevant fluid dynamic processes is lacking. Here we focus on the effect of continental size. Continents covering 30% of the surface are representative of a supercontinent such as Pangea, smaller continents (10% of Earth's surface) are representative of present day Asia, and still smaller continents (3% of Earth's surface) are similar to present day Antarctica. These continents are introduced into simple end-member mantle flow regimes characterized by combinations of bottom or internal heating and uniform or layered mantle viscosity. We find that large scale mantle structure, and correspondingly the large scale displacement of continents, depends not only on mantle heating mode and radial viscosity structure, but also on continental size. Supercontinents promote heterogeneity on the largest scales (spherical harmonic degree one), especially when combined with strong bottom heating and a high viscosity lower mantle. Degree one heterogeneities in turn drive cyclical continental motion, with continents moving from the hot to the cold hemisphere on time scales of several hundred million years. Smaller continents are unable to initiate degree one convection. As a result, their motion is governed by shorter length and time scales. We apply these insights toward understanding the motion of several continents to study the aggregation and dispersal of continental groups.

T32C-07 1510h

Non-equilibrium temperatures and cooling rates in thick continental lithosphere

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Beneath cratons, the lithosphere probably extends to more than 200km depth, which has important implications for the interpretation of heat flow measurements and xenolith geothermobarometry data. The time-scale for diffusive heat transport in a 200 km thick lid is about 1 Gy, which is smaller than, but comparable to, the half-lives of the main radiogenic isotopes of Uranium, Thorium and Potassium. In this case, the thermal structure of the lithosphere is not in equilibrium with the instantaneous rate of radiogenic heat generation and with the heat supply at the base of the lithosphere. For a given amount and distribution of heat sources, the instantaneous vertical temperature profile exhibits significant curvature and may be hotter than the steady-state prediction by as much as 150K. Comparison of (P,T) data with steady-state thermal models therefore leads to an overestimate of the mantle heat flow. The present-day rate of cooling in deep lithospheric material depends on the values of crustal and mantle heat production and on the rate of heat supply from the convecting mantle. Typical values of the cooling rate are in the range of 50-150 K/Gy, close to values reported by F. Albarede for xenoliths from South African kimberlites (Geophys. Res. Lett. 30, 1015, 10.1029/2002GL016484, 2003). Monte-Carlo calculations have been performed to investigate the range of values for the lithosphere thickness, mantle heat production and basal heat flux which are compatible with xenolith (P,T) arrays and surface heat flow determinations.

T32C-08 1525h

Stability of a Chemical Boundary Layer Within a Convecting Mantle

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Chemical lithosphere can be stabilized from deformation by possessing a higher viscosity and/or a higher plastic yield strength than the convecting mantle. Numerical simulations were conducted to determine the transitions between viscous and localized plastic deformation of a chemical lithosphere within a convecting mantle. Several deformation modes were mapped as were the parameter conditions required for lithosphere stability. The value of the friction coefficient that lead to lithosphere stability was found to be dependent upon the thickness of the chemical lithosphere and the mantle Rayleigh number. The value of the viscosity contrast that lead to stability was found to depend on chemical lithosphere thickness, but only weakly on the mantle Rayleigh number. These results are consistent with simple physical scaling laws. Outside of the stability parameter windows, both localized and distributed deformation modes were observed. Further scaling laws are being developed to help physically explain the parameter space transitions from localized to distributed deformation regimes.

T32D MCC: 3007 Wednesday 1340h

Structure and Tectonics of the Western U.S. and the Gulf of California II *(joint with G, S, V)*

Presiding: **N J McMillan,** New Mexico State University**; C A Shaw,** University of Wisconsin-Eau Claire

T32D-01 1340h

Diffuse Continental Deformation in the Western US: A Preliminary 4D Modeling Effort of the GEON Project

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The GEON (GEOscience Network, www.geongrid.org) is a large NSF/ITR research project for building a national geosciences information cyber-infrastructure that will seamlessly integrate geoscience data and analytic tools. One of the major goals of GEON is to facilitate studies of four-dimensional (4D) evolution of continents. We have developed a suite of 3D finite element models as a pilot study of GEON to address some of the first-order questions of continental deformation in the western US in the past 80 Myr: 1) What caused the Laramide deformation? Was it flat subduction or gravitational spreading of a high-standing Sevier plateau in the western Cordillera? 2) What caused the Tertiary extension in the Cordillera? Did metamorphic core-complex formation directly lead to Basin and Range extension? 3) What is the major driving force for the present crustal deformation in the western US? By exploring the impact of possible changes of tectonic boundary conditions and driving forces with time, we derive a preliminary model of the 4D evolution of diffuse continental deformation in the western US. Through this work we will also show how the multi-scale and multidisciplinary data sets from GEON may be used to help scientific investigations, and the computing resources that will be provided to the geoscience community by the GEON grid.

T32D-02 1355h

Laramide Magmatism in the SW US as a Consequence of Lithospheric Thinning and Thermal Structure Created by Late Jurassic Continental Rifting

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Spatial and temporal patterns of Late Cretaceous-Early Cenozoic magmatism in Arizona, New Mexico, west Texas, and northern Mexico demonstrate that arc-like magmatism was prevalent up to 1000 km east of the Farallon-North America trench. Prior to the Late Cretaceous, Mesozoic magmatism was focused in the Sierra Nevada region, with widespread peraluminous intrusions throughout the Cordilleran interior. As early as 80 Ma, however, magmatism shifted far inboard and persisted as late as 50 Ma. Early models for this phenomenon relate an eastward sweep of magmatism to the progressively decreasing subduction angle of the Farallon plate. This model is no longer tenable, for several reasons. 1) Investigation of shallow-angle subduction worldwide demonstrates that magmatism ceases as the subduction angle decreases; modern shallow-angle subduction zones are nearly devoid of active volcanoes.

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2) Thermochemical models for melting in subduction zones require both metasomatism of the mantle wedge by slab-derived fluids and convection of the hydrated mantle wedge downward until it reaches its solidus temperature. These processes are minimized or precluded by elimination of the mantle wedge during low-angle subduction. 3) Advances in the quality and quantity of geochronologic data suggest that the locus of magmatism shifted abruptly from near-trench to far inboard, rather than sweeping gradually eastward as previously thought. We propose that Laramide magmatism in the SW US and northern Mexico was not caused by subduction processes, although the igneous rocks have arc-like geochemical characteristics. Instead, we suggest that Laramide magmatism was controlled by the mantle structure inherited from the preceding tectonic event. During Late Jurassic time, southwestern North America experienced extension, resulting in the Border continental rift. The Border rift is defined by thick accumulations of fault-bounded alluvial and marine strata intercalated with rhyolitic ash-flow tuffs and asthenosphere-derived basalts. Border rift basalts have been documented in Kimmeridgian/Tithonian marine and terrigenous strata in the Chiricahua Mountains of SE AZ, in Upper Jurassic strata in the Little Hatchet Mountains of SW NM, and as allochthonous blocks in diapiric Upper Jurassic salts in the La Popa basin of NE Mexico. Because the paleogeographic extent of the Border rift coincides with the region of Laramide magmatism, we interpret Laramide magmatism as the result of dehydration of the Farallon slab and subsequent mantle melting as the slab entered hot asthenospheric mantle emplaced to shallow depths during Border rift extension. Partial melts of metasomatized mantle experienced crustal contamination during ascent, resulting in Laramide igneous rocks with continental arc-like geochemical signatures.

T32D-03 1410h

Window into the middle crust: A deeply exhumed Proterozoic orogenic plateau in the western U.S.

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A widespread 1.45-1.35 Ga tectonic episode involving A-type granitic magmatism, regional metamorphism, and widespread deformation profoundly modified Proterozoic continental lithosphere throughout the southwestern United States. We suggest that this intercontinental tectonism is best understood in the context of a broad orogenic plateau that formed inboard of an Andean-type convergent margin that stretched more than 5000 km from the Baltic craton to southern California and perhaps into Australia. An extensive 40Ar/39Ar thermochronologic study (more than 250 new dates) in the southern Rocky Mountains suggests that the current level of exposure in basement rocks broadly coincides with a ca. 1.4 Ga mid-crustal magma-rich layer where regional heating enhanced by advection in the lower crust gave way to purely convective heat transfer in the upper crust. Thus, 1.4 Ga tectonism in the southwestern United States may represent a deeply exhumed example of magmatic modification of the mid-crustal brittle-plastic rheologic transition. Similar processes may occur in mid-crustal magma layers that are inferred beneath modern intracontinental orogenic plateaus such as Tibet and the Andean Altiplano-Puna plateau An orogenic plateau model for 1.40 Ga tectonism is also supported by: widespread NW directed contraction and crustal thickening during syntectonic pluton emplacement, widespread elevated temperatures at middle crustal depths with higher temperatures towards an inferred plate margin to the south, slow cooling/lack of rapid unroofing following 1.45-1.35 Ga metamorphism, and the necessity to provide the gravitational potential to drive post- 1.4 Ga erosional removal of 10 km of crust over tens of millions of years to produce the Great Unconformity. Geophysical evidence for a high-velocity lower crust is consistent with a 1.4 Ga basaltic underplate related to the production of A-type magmas that carried heat into the middle crust. If our model is correct, the southwestern U.S. may be a deeply exhumed analog for modern intracontinental orogenic plateaus that could provide insights into mid-crustal processes of intracontinental deformation.

T32D-04 1425h

Gravitational Load Shedding and Metamorphic Core Complex Development

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A number of competing theories have attempted to explain the domical or archlike features in the Basin and Range Province (BRP) known as metamorphic core complexes. While current consensus attributes their formation to Mid-Tertiary extension, the formation of some core complexes may have predated this extension and the mechanisms leading to uplift of the cores remain controversial. Current models appeal to isostatic uplift of lower crustal material in response to some form of tectonic denudation. We investigate an alternative mechanism, independent of Basin and Range extension, which may contribute dynamically to the formation of some core complexes in this region. Thermally induced thinning of the elastic crust can lead to the subsidence of anomalously dense material previously supported by elastic stresses. The upper crust in the BRP is sufficiently thin that runaway subsidence, followed by shedding of the dense load, is plausible for geologically reasonable loads. The subsequent uplift due to stored elastic stresses in the crust and the buoyancy of lighter material entrained into the lower crust by the sinking load could give rise to features and topography consistent with those of BRP core complexes.

T32D-05 1440h

SAR Interferometry for Measuring Recent Deformation of the Eastern Snake River Plain

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The Eastern Snake River Plain (ESRP) is a NE-trending volcanic basin that defines the track of the Yellowstone hotspot across southern Idaho. Previous studies of the ESRP interpreted up to 6 km of upper crustal subsidence and 15-25 % extension since 10-15 Ma. Leveling studies conducted between 1906 and 1983 and more recent GPS studies indicate that at least some ESRP regions continue to actively extend and/or subside. To document the regional pattern of active deformation, we have employed interferometric synthetic aperture radar (InSAR) techniques. Snow- and rain-free ERS-1 and ERS-2 SAR images from 1992-2003 with less than 400 m baselines were acquired for areas with large, young basaltic lava flows with flat surfaces, sparse vegetation and little soil cover, such as the Craters of the Moon, Wapi, and Hell's Half-Acre lava fields. These areas are ideal for preserving surface characteristics and maintaining SAR phase coherence between images for 4-10 years, time spans that are required to detect the slow rates of topographic change on the ESRP. Results from the Wapi region indicate that differential subsidence and/or extension from 1993-1997 was symmetrically disposed about the axis of the Great Rift, with greater Line of Sight (LOS) topographic change on the margins and less along the rift. Results from the Craters of the Moon region indicate variable amounts of upper crustal subsidence and extension from 1993-1997, although the absolute amount requires further calibration by GPS analysis. Up to 2 mm/yr of differential LOS change is evident in the region over this period, with a domain of less LOS change across the axis of the Great Rift and a domain of greater LOS change to the west. The line that separates domains is relatively sharp, oriented north-northwest, and if extrapolated northward is on strike with the surface trace of a west-dipping Basin-Range normal fault. One interpretation of this pattern is that Basin-Range half-graben fault blocks underlie the ESRP. Alternatively, the observed pattern of differential uplift may be part of a larger, symmetrical pattern characterized by greater subsidence on the flanks of the Great Rift than along its axis. Further testing of these hypotheses will occur through field study of the Basin-Range fault kinematics and a GPS campaign scheduled for the Fall of 2003 to previously surveyed sites in the study area.

T32D-06 1455h

Palinspastic Reconstructions of the Gulf of California Based on Airy Isostatic Profiles: Evidence for One Kinematic Phase of Neogene Shearing

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Palinspastic reconstructions of serial crustal profiles drawn parallel to transform faults yield new estimates of total shear and define relative magnitudes of orthogonal versus transform-parallel rift components across the Gulf of California. Crustal thicknesses in serial cross sections across the Gulf depression were calculated from topographic profiles assuming local airy isostatic compensation, and model parameters like crust-mantle density contrast and thickness of a reference crust were calculated by fitting predetermined crustal thickness variations in the Peninsular Ranges and Gulf extensional province (e.g., Lewis et al., 2001, JGR). The serial cross sections show that the magnitude of seafloor spreading is highly variable and correlated with the geomorphologic expression of the spreading centers; magmatically robust ridges like the EPR, Alarcon and Guaymas have accommodated 210 to 340 km of separation, whereas, the magmatically starved centers that form deep rhombochasmic basins like the Pescadero, Carmen and Farallon have accommodated only 80-130 km of separation. Nonetheless, differences in the magnitude of seafloor spreading are systematically offset by differences in the magnitude of continental extension, and total tectonic separation calculated in nine separate profiles generally ranges from 450-500 km. Profiles across the southern tip of Baja show less total separation than those farther north, which indicates that there is small component (5-20 km) of margin-perpendicular tectonic transport. Because the total separation vector is large in magnitude and subparallel to the modern transforms, we infer that the Gulf must have opened in one kinematic phase of Neogene shearing.

T32D-07 1510h

Seismic Images of Faulting and Fossil Subduction of the Southern Baja California Margins

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From September to November 2002, a marine geophysics experiment was carried out, using 2 ships and onshore personell, recording deep MCS (Multichannel Seismics), wide angle, gravity, magnetic and bathymetric data. The main objective of this experiment is to better understand the continental breakup processes and the rifting of the Baja California Peninsula from Mexico mainland. An array of airguns with a total air volume of 8000 cu.in. was the seismic source and a 6000 km-long, 480-channel streamer was used to record the deep MCS data. This equipment was towed by the R/V Maurice Ewing. A series of stacked and migrated sections have been obtained, showing a number of noticeable structures. To the W of the line corresponding to the Pacific margin, the fossil trench is covered by recent sediments, that are part of the Magdalena Fan. Towards the E, near the slope break, the Tosco-Abreojos fault zone is clearly imaged, showing some extensional component. Further to the E, an old syncline is covered in erosive unconformity by recent sediments. In the eastern part of the section, a half-graben structure can be observed. Under this structure, a reflective zone can be interpreted as the mylonitic zone corresponding to a detachment. Some basement scarpments seem to be parallel faults to the semigraben master fault. Other normal faults in the sediments of the basin are synthetic and antithetic with it. The master fault probably is the continuation to the S of the Santa Margarita-San Lazaro fault, reported previously as a detachment in Santa Margarita and Magdalena islands. The seismic line in the Gulf of California margin begins at a conspicuous slope at the mouth of the La Paz Bay, and corresponds to the same strike-slip fault observed in Partida and Espiritu Santo islands. The rest of the line is characterized by numerous strike-slip and normal faults, producing strong bathymetric variations.

T32D-08 1525h

Late Miocene (Proto-Gulf) Extension and Magmatism on the Sonoran Margin

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Constraints on the magnitude and character of late Miocene (Proto-Gulf) deformation on the Sonoran margin of the Gulf of California extensional province are key to understanding how and when Baja California was captured by the Pacific plate and how strain was partitioned during the early stages of this transtensional rift system. Our new geologic mapping in southwestern Sonora and $^{40}Ar/^{39}Ar$ dating of pre-, syn-, and post-tectonic volcanic units indicate that late Miocene deformation and volcanic activity were largely restricted to a NW-trending, 100-120 km wide belt adjacent to the coast. Inboard of this belt, NW-SE extension is mainly older (>15 Ma) and occurred in an intra-arc or back-arc setting. Proto-Gulf deformation within the coastal belt was profoundly transtensional, with NW-striking, dextral strike slip faults operating in concert with N-S and NNE-striking normal and oblique slip faults to produce an inferred NW or NNW tectonic transport direction. The total amount of late Miocene NW directed dextral shear within the coastal belt is still poorly constrained, but may exceed 100 km. The locus of deformation and volcanic activity migrated westward or northwestward within the Sonoran coastal belt. in the eastern portion (Sierra Libre and Sierra El Bacatete) major volcanic activity commenced at $\sim$13.0 Ma and peaked at 12.0 Ma, and major faulting and tilting is bracketed between 12.0 and 10.6 Ma. Further west in the Sierra El Aguaje/San Carlos region, major volcanic activity commenced at 11.5 Ma and peaked at 10.5 Ma, and most faulting and tilting is bracketed between 10.7 and 9.3 Ma. On the coastal mountains northwest of San Carlos, rift related faulting and tilting continued after 8.5 Ma. Voluminous late Miocene (13-8 Ma) volcanic rocks within the Sonoran coastal belt were erupted from numerous centers (e.g. Sierra Libre, Guaymas, Sierra El Aguaje). These thick volcanic sections are compositionally diverse (basalt to rhyolite, with abundant dacite and andesite), and are intimately associated in space and time with tectonic activity. Overall, the Sonoran coastal belt provides a spectacular example of distributed transtension and associated magmatism that ultimately led to rupturing of the continental lithosphere.

T32E MCC: 3007 Wednesday 1600h

Late Cenozoic Tectonics, Climate, and Topography in the Central and Southern Andes II *(joint with G, H)*

Presiding: **E R Sobel,** Institut für Geowissenschaften**; R Amundson,** Division of Ecosystem Sciences

T32E-01 1600h INVITED

Drainage Divide Migration, Orographic Precipitation, and Uplift in the Southern Andes

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Statigraphic and geomorphic evidence within the Patagonian Andes suggests that rapid uplift starting in lower to middle Miocene caused drastic changes of drainage and sediment transport patterns. In particular, capture of formerly E-draining channels by headward erosion of W-draining fluvial systems indicates that an eastward migration of the drainage divide took place in this area. We hypothesize that this migration was caused by the development of an asymmetry in the distribution of precipitation and erosion that progressively concentrated on the windward (western) side of the uplifting mountain belt. We coupled the bedrock fluvial power-law incision model to climatic models that consider the impact of relief on precipitation with constant base-levels on either side of the uplift zone. Forward models indicate that when rock uplift rates are low, relief remains relatively subtle within the orogen, the topography is approximately symmetric, and precipitation is uniformly distributed over the mountain belt. However, high rock uplift rates concentrate precipitation along the windward slopes of the orogen at the expense of the leeward slopes. The increase in erosional power on the windward slopes causes the drainage divide to migrate towards the leeward portions of the orogen. For high uplift rates, enough topography is constructed to completely starve moisture from the leeward portion of the orogen. This eliminates erosional power within the fluvial systems in these areas, preventing the development of steady-state topography. To apply this model to the southern Andes, we used topographic and precipitation data from this region to constrain the parameters in the precipitation and fluvial bedrock incision model. We found that an order-of-magnitude increase in rock uplift rates or decrease in the erosional efficiency during the lower to middle Miocene can explain the approximate magnitude of drainage divide migration observed. Therefore, we speculate that an increase in uplift rates within the southern Andes has concentrated precipitation along the western flanks of the mountain belt, reduced precipitation along the eastern flanks, and forced the drainage divide to the east.

T32E-02 1615h

Tectonic feedbacks in the Southern Andes arising from variations in the equilibrium line altitude

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There is considerable interest on the role of climate in controlling topography and local relief in tectonically active landscapes. Much of this discussion has focused on the role of fluvial erosion, but more recently the debate has turned to include glacial erosion as well, which is probably important in limiting the maximum elevation in convergent mountain belts such as the Andes, in which the summit regions are covered by significant amounts of alpine glaciers. We present a theoretical model that shows that the Andes presents a clear test case of quantifiable feedbacks between climate and tectonics. A convergent wedge model of Andean orogen development suggests that the lowering of the Equilibrium Line Altitude (ELA) since the Late Miocene may have lead to a lowering of the relief in the Southern Andes of around 1 km. Analytic calculations suggest that a lowering in relief of the ELA is capable of reducing the mass of the orogen by in excess of 30%. These estimates are supported by a numerical model of fluvial-glacial erosion at convergent orogens, with which we predict that the rate of tectonic rock uplift in the Southern Andes may have increased by more than 20% since the inception of the glacial cycles of the Quaternary, in response to increased erosion.

T32E-03 1630h

Applying low temperature thermochronology to resolve the climatic, erosional and tectonic controls on the geomorphic development of the southern Andes

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The southern Andes are an ideal orogen in which to study the interplay between tectonics, variable climate, and glacial erosional processes on the geomorphic development of mountains. They represent a mid- to high-latitude high relief mountain chain developed largely since late Cenozoic times in a relatively simple non-collisional convergent margin tectonic setting perpendicular to the prevailing mid-latitude westerly weather systems. An orographically induced rainshadow is well developed with the leeward (east) side receiving less than 10 % the precipitation of the windward (west) side. Preliminary new apatite (U-Th)/He (AHe) low temperature thermochronologic data have been obtained from samples previously analysed using the fission track (AFT) method to investigate in more detail variations in late Cenozoic cooling and hence erosional denudation both along strike and across the southern Andes. The cooling histories indicated by the AHe ages agree well with earlier AFT results, and indicate increased amounts of late Cenozoic erosional denudation on the windward side, with the youngest ages and amounts of exhumation apparently increasing toward the present day topographic divide. The AHe ages, when combined with AFT thermal modelling, also provide a well constrained age of ca. 8 Ma for the onset of accelerated denudation close to the present day topographic divide at ca. 47-48°S. With the acquisition of a more detailed low temperature thermochronologic AHe data we aim to test geodynamic models that predict the effects of variable climate (orographic precipitation), glacial and fluvial erosion, and tectonic uplift in a steady state orogenic wedge similar to the situation in the southern Andes. Such models imply similar topographic expression, but different spatial erosion responses to tectonic uplift in an orogenic wedge dependent on whether fluvial or glacial processes were the dominant erosion mechanism. Such differences should be better resolvable with the higher precision and lower temperatures (and hence nearer surface denudation record) provided by AHe data.

T32E-04 1645h

Ephemeral Sedimentary Basins and Limits of Lateral Plateau Growth at the Eastern Puna Margin, NW Argentina

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Similar to the northeastern margin of the Tibetan Plateau the eastern margin of the Puna Plateau of the southern Central Andes is characterized by laterally growing ranges and intervening intramontane basins in a tectonically active and arid environment. However, in contrast to Tibet, lateral plateau growth along the SE Puna by incorporation of filled sedimentary basins appears to be inhibited. In fact, reverse-fault bounded