T42A-02 1050h

Depth of the tectosphere beneath Kaapvaal craton

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Although the existence of a thick, cold, highly depleted lithosphere – the so called tectosphere – beneath Archean cratons is generally accepted, its exact thickness is still controversial. Imaging the chemically distinct tectosphere using seismic methods have been hindered by two fundamental problems: (1) the difficulty in separating effects of temperature and composition on seismic velocities and (2) the poor depth resolution of seismic tomography. A recent study, however, suggested that V_p/V_s ratio could be used in diagnosing major compositional (e.g., $Mg\#$) and thermal anomalies since V_p/V_s ratio is more sensitive to composition than to temperature. Geodynamic studies, on the other hand, suggest that seismic observations of the topography of the 410-km discontinuity could be used as constraints on the thickness of tectosphere. We have measured the S-P travel-time residuals across the Kaapvaal Seismic Array and found a systematic difference between the craton and the surrounding mobile belts. The Kaapvaal craton shows a larger negative S-P residual, and therefore a lower V_p/V_s ratio, than the adjacent mobile belts, which indicates the existence of the highly depleted tectosphere ($Mg\#$ ~92-94) beneath the Kaapvaal craton. We also processed high-quality receiver functions with common-conversion-point gathering and pre-stack depth migration techniques and two-dimensional velocity reference models. The resulting images consistently show a flat 410-km discontinuity beneath the entire array. This observation, combined with the results of geodynamical modeling, allows us to place limits on the thickness of the tectosphere, which is between ~160 and ~370 km.

T42A-03 1105h

Relict Slabs Within the Roots of the Slave and Superior Provinces Observed With Deep-Looking Magnetotellurics

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Important clues to the ancient origin of cratonic lithosphere can be found with deep looking magnetotelluric methods. Electrical strike direction observed in the western Superior Province of Canada show a dramatic correlation with crustal fabrics possibly related to Archean subduction. Upper mantle conductors with resistivities as low as 10 Ohm m embedded within the lithosphere of the Slave and Superior Provinces are approximately two orders of magnitude higher than petrophysical modelling predict for an olivine or pyroxene mineralogy dominated upper mantle. Given the depth location, age, and tectonic setting as well as the observed conductivity of these electrical conductors, we conclude that they are likely due to carbon in the form of interconnected graphite. The evidence for deep-seated graphitic conductors spatially related to other deep-seated geophysical and geochemical anomalies may be taken together with recent independent estimates of upper mantle oxygen fugacities that suggest the mantle was at some point within two log units of the iron-wüstite buffer to suggest that partial melting and formation of the cratonic root may be related to redox melting during Meso and Neo Archean times. The geometrical form of these conductors, in addition to other lines of evidence, can be taken as evidence for Archean subduction near the end of the major phase of craton formation.

T42A-04 1120h

3-D Imaging of the Precambrian Winagami Sill Complex in Northwestern Alberta, Canada: Continental Rebar Revealed?

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The Winagami sill complex, discovered by Lithoprobe's CAT'94 and PRAISE'95 multichannel seismic reflection experiments, was intruded during the Paleoproterozoic into the crystalline basement underlying the Western Canada Sedimentary Basin of northwestern Alberta, Canada. Spanning an area of at least 120,000 km^2, the extent of this upper crustal feature is comparable to large Phanerozoic igneous provinces. The intrusion of such sill complexes has been interpreted as a fundamental stage in the process of cratonization and a key to the strength of cratonic blocks. The very presence of such structures in northwestern, and also southwestern, Alberta may have contributed to the development of cratonic arches along the ancient rifted margin of North America which significantly impacted regional depositional environments. Using a 3-D seismic reflection dataset collected for exploration purposes by the Canadian petroleum industry that probed to depths of approximately 15 km, we have undertaken a 3-D investigation of the Winagami reflectors. To date, we have imaged the top of the Winagami sequence in 3-D over an area of 400 km^2, producing the first areal seismic image of a Precambrian sill complex at depth. Secondly, we have obtained polarity constraints from known shallower reflections for comparison with the Winagami reflections to characterize the impedance contrast. Lastly, we have extracted areal characteristics using amplitude analyses and attributes on both pre-stack and post-stack data to better map local variations in reflectivity. These may be revealing thickness or lithological variations. Our results represent the first attempt to gain a better understanding of the nature of these important structures using industry 3-D seismic reflection techniques.

T42A-05 1135h

Pre- and Post-Cratonization History of the Northern Wyoming Province

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Cratonization of the northern Wyoming Province (NWP) occurred 2.8-2.9 Ga with the cessation of convergent margin magmatism and the development of passive margin sedimentary sequences. Cratonization was preceded by an extended period of crustal growth via episodic, convergent margin magmatism; major events are dated at 2.8-2.9 and 3.2-3.5 Ga. Earlier events are recorded by numerous detrital zircon and Nd model ages, which indicate felsic magmatism was ongoing by at least 4.0 Ga. TTG magmatism at 2.8-2.9 was the culminating event and is clearly imprinted in the isotopic systems of mantle xenoliths. Cratonization was followed by tectonic and magmatic quiescence from 2.8-1.9 Ga. Subsequent tectonism is marked by a 2-stage Paleoproterozoic incorporation of the NWP into Laurentia. Stage 1 (1.8-1.9 Ga) involved the juxtaposition of the NWP with the Archean Superior and Hearne cratons and the production of minor calc-alkaline magmatism (e.g., Little Belt Mountains of the Great Falls Tectonic Zone). Stage-2 (1.7-1.8 Ga) involved the accretion of Paleoproterozoic terranes (2.4-1.8 Ga) to the amalgamated Wyoming-Laurentian continent, resulting in granulite facies metamorphism, but little magmatism, in the NWP (e.g., Tobacco Root Mountains). Paleoproterozoic tectonism in the NWP is distinctive because of: 1) a paucity of contemporaneous magmatism and 2) a lack of tectonic activity away from the active margins. These observations suggest that the NWP developed a long-lived and structurally robust tectosphere contemporaneously with the stabilization of a felsic crust 2.8-2.9 Ga. This tectosphere appears to have had a substantial impact on the subsequent geologic evolution of the northern Rocky Mountain crust, including the development of the Belt basin, the Yellowstone- Snake River Plain system, and a range of Laramide and Sevier-style structures.

T51A CC: 220 C-E Friday 0830h

Structure and Dynamics of the Crust-Lithosphere-Mantle System: Observations and Models Posters

(joint with G, GP, S, V, SEDI)

Presiding: **M I Billen,** University of California, Davis**; M A Soofi,** University of Calgary

T51A-01 0830h POSTER

Investigating Plume Mobility and Heat Transport in 3D Numerical Mantle Convection Models Incorportating Plate-like Surface Motion

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The influence of plate-scale motion on mantle plume generation and mobility is not well understood. The issue takes on a particular importance as some authors have pointed out that a significant fraction of core heat flux could be carried into the mantle by plumes that are subsequently entrained by upwelling currents associated with the large scale flow beneath diverging plates. It has independently been suggested that, in the absence of the organising influence of plate scale flow, many plumes may not have the individual buoyancy required to traverse the mantle. Both of these scenarios separately suggest that estimates of core heat loss based on the buoyancy flux calculated at well defined hotspots could be potentially underestimated. We invesigate the ratio of surface to basal heat loss as well as plume mobility in a suite of 3-D numerical convection calculations. This is done by modelling different tectonic plate settings where each model is characterised by an isothermal bottom boundary and different depth-dependent internal heating rates. We investigate the influence of plate size and the ratio of poloidal to toroidal power in the specified plate motion in a series of calculations. We also examine the influence of viscosity stratification and thermal expansivity depth-dependence on plume mobility. Plume characteristics including longevity and relative fixity are measured, as is the rate of basal heat loss. Our findings are compared with results from laboratory models and previous numerical studies and are finally used to comment on conventional estimates of core heat loss.

T51A-02 0830h POSTER

Numerical Convection Modeling and the Ocean Floor Topography Constraint on Mantle Layering

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The amount of ocean floor topography caused by upwelling mantle plumes can be used as a constraint on the degree of layering of convection in the Earth's mantle (Davies, 1998). In this contribution, we present a suite of numerical models of convection in the Earth's mantle with varying degrees of layering at 660 km depth. An oceanic plate is modeled by imposing a constant surface velocity boundary condition and requiring a condition of 0 net tangential stress at the base of the lithosphere where a large viscosity jump is imposed. For convection models with Earth-like Rayleigh numbers, we calculate the surface topography for varying degrees of mantle layering and for various strengths of internal heating and viscosity stratification. The efficacy of this constraint on the degree of mantle layering is examined.

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T51A-03 0830h POSTER

Spontaneous Flow Reversals in Mantle Convection Models with Internal Heating - Independent Confirmation

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One enigmatic aspect of plate motions is the apparent ability of plates to affect relatively rapid changes in their directions of motion. The two-dimensional analogue of such a change in direction of plate motion is a flow reversal wherein surface plates change direction by 180 degrees. It has been demonstrated by Lowman, King and Gable that flow reversals and sudden changes in direction may occur spontaneously in two-dimensional and three-dimensional models, respectively. The numerical flow models employed by these authors use spectral decomposition in the lateral direction(s) and finite-difference approximations in the vertical direction for both 2D and 3D studies. The implications of these numerical results are sufficiently important that they should be verified by different numerical models using different numerical techniques. If several different models obtain similar results we may be more confident that we are observing an unexpected physical result rather than an undesirable numerical result. We have, therefore, employed a two-dimensional purely finite-difference numerical model to test the robustness of the flow reversals reported previously but with different numerical approximations. We find flow reversals also occur in our numerical model with similar parameters to those employed by Lowman et al. We present a systematic map of parameter space in which flow reversals occur and compare this to previously reported results. This study provides independent confirmation of the unexpected physical result that internal heating in models with thick surface plates leads naturally to spontaneous flow reversal in two-dimensions.

T51A-04 0830h POSTER

Dynamical Analysis of the Abrupt Motion Change of the Pacific Plate at 43 Ma

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The causes and mechanisms for abrupt changes in tectonic plate motions are important and unresolved issues in geodynamics. We have analyzed the direction change data of the Pacific plate at 43 Ma using principles of angular momentum. With the angular velocity data of the Pacific plate (Koppers et al., EPSL, 185, 2001) and the results of Cenozoic plate motions (Gordon and Jurdy, JGR, 91, 1986), we determined the position and boundary shape of the Pacific plate at 43 Ma and computed its moment of inertia. Then, we calculated the increment of angular momentum between 48–43 Ma and the average sum of the torque on the Pacific plate, which represents the vector difference between the driving and resisting torques. This provided us with direct constraints on the magnitude of the forcing which may have caused the abrupt motion change of the Pacific plate. Based on our analyses, the change in plate motion at 43 Ma may have been related to a change in the nature of the plate boundary along the southwest margins of the Pacific; namely, the initiation of widespread subduction at this time along this portion of the plate boundary. We also find that our predicted average torque acting on the Pacific plate during the period of motion change is 18 orders of magnitude smaller than estimates of the driving torque which have been derived from previous studies. This suggests that the plate motion is a highly constrained dynamic system with a strong damping influence from the underlying, coupled mantle.

T51A-05 0830h POSTER

Variation of mean continental elevation with continent and time

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What factors determine the mean elevation and thickness of an individual continent? Given total continental crust volume, what determines the mean thickness (and hence total area) of all continents? Could mean continental thickness have doubled and continental area have halved in the geologic past? I present a first-order model assuming that continental mean height is the steady state height controlled by uplift and erosion. The model predicts that it is more difficult to erode a larger continent. Hence mean continental height increases as continental area increases. This prediction is consistent with the general trend between present-day continental elevation and area (except for Antarctica), and can fit the trend well. This is the first time the relation between continental area and mean elevation is quantitatively explained. The model is applied to investigate variations of mean thickness of continental crust over the last 600 Myr over which the continental crust mass is assumed to be constant. Because a change in the number of continents leads to change in the area of continents, it is predicted that the mean continental thickness increases as the number of continents decreases. Nevertheless, the thickness variation is small, amounts to about 10% from one continent to six continents. Change in the number of continents leads to a sea level fluctuation of about 0.3 km, with the lowest sea level coinciding with times of Pangeas. This prediction is consistent with relative sea level curves. It is concluded that the number of continents played a major role in Phanerozoic sea level changes.

T51A-06 0830h POSTER

Geophysics Fatally Flawed by False Fundamental Philosophy

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For two centuries scientists have failed to realize Laplace's nebular hypothesis 1796 of Earth's creation is false. As a consequence, geophysicists today are misinterpreting and miscalculating many fundamental aspects of the Earth and Solar System. Why scientists have deluded themselves for so long is a mystery. The greatest error is the assumption Earth was created 4.6 billion years ago as a molten protoplanet in its present size, shape and composition. This assumption ignores daily accretion of more than 200 tons/day of meteorites and dust, plus unknown volumes of solar insolation that created coal beds and other biomass that increased Earth's mass and diameter over time! Although the volume added daily is minuscule compared with Earth's total mass, logic and simple addition mandates an increase in mass, diameter and gravity. Increased diameter from accretion is proved by Grand Canyon stratigraphy that shows a one kilometer increase in depth and planetary radius at a rate exceeding three meters $10ft$ per Ma from start of the Cambrian $540Ma$ to end of the Permian $245Ma$each layer deposited onto Earth's surface. This is unequivocal evidence of passive external growth by accretion, part of a dual growth and expansion process called "Accreation" $creationbyaccretion$. Dynamic internal core expansion, the second stage of Accreation, did not commence until the protoplanet reached spherical shape at 500-600 km diameter. At that point, gravity-powered compressive heating initiated core melting and internal expansion. Expansion quickly surpassed the external accretion growth rate and produced surface volcanoes to relieve explosive internal tectonic pressure and transfer excess mass (magma)to the surface. Then, 200-250 Ma, expansion triggered Pangaea's breakup, first sundering Asia and Australia to form the Pacific Ocean, followed by North and South America to form the Atlantic Ocean, by the mechanism of midocean ridges, linear underwater volcanoes, that enable planetary expansion the same way cranial sutures permit human skulls to grow to maturity. Expansion is shown by the Asian and Australian trenches, from Kamchatka to the Marianas, and from Samoa to the tip of Macquarie Ridge south of New Zealand, that are mirror images of the western coasts of North and South America. This is clear evidence neither the Atlantic nor the Pacific Ocean existed 250 Ma when Earth was much smaller. In just 250 Ma external accretion and internal core expansion increased Earth's diameter from 7640 km to 12,735 km and increased total surface area to 361,060,000 sq. km, the area occupied by today's oceansoceans that did not exist 250 Ma when Earth was slightly larger than Mars is today $6787km$. The fallacy of the nebular hypothesis did not become apparent until after Oliver and Isacks introduced the concept of subduction in 1967. Subduction was based on the false assumption that Earth's diameter is constant and unchanging, and spawned the theory of Plate Tectonics that "revolutionized" geophysics in a short period of timea "revolution" destined for failure. Evidence is presented showing all solar bodies originate as comets $fragmentsofsupernovaeexplosions$ captured by the Sun that become meteoroids or asteroids by external accretion of meteorites and dust from over 370 known meteor streams.$Terentjeva$, 1964 Accreation replaces the nebular hypothesis and rejuvenates Carey's Earth Expansion theory that, unfortunately, was pushed aside by plate tectonics because it lacked a plausible mechanism. However, expansion carries an ultimate threat to Mankind's tenure on Earth and exploration of Mars as the future home of Mankind takes on added significance.

URL: http://www.expanding-earth.org

T51A-07 0830h POSTER

Kinematic Controls on Low-Pressure Anatexis

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We have employed one- and two-dimensional analytical and numerical techniques to model the generation of regional low-pressure crustal anatexis, with a primary interest in determining the regional conductive and advective controls in the absence of anomalous heat production and magmatism. Our models allow for erosion and subsidence, as well as for independent thinning mechanisms between the crust and mantle portions of the lithosphere. Heat sufficient for low-pressure crustal anatexis can be derived only through restricted kinematic histories, each of which should leave a unique textural record in the partially melted rocks. Enhanced heat flow from the asthenosphere sufficient for low-pressure anatexis requires a thin mantle lithosphere, achieved by mechanisms such as necking or delamination. In a scenario of complete delamination followed by conductive lithospheric thickening, temperatures sufficient for crustal melting at pressures below the aluminosilicate triple point are possible only if the crust is itself thin (on the order of 20 km). If the mantle lithosphere does not thicken but instead remains thin following delamination, low-pressure anatexis can readily occur in thin crust. In normal thickness crust (30-35 km), this scenario unrealistically requires the base of the crust to sustain temperatures in excess of 1000°C for several million years without magmatically advecting that heat to higher levels. Thus we conclude that, in the absence of significant injected magma, thin crust as well as thin mantle lithosphere are requirements for low-pressure crustal anatexis. To evaluate the kinematic role of the crust during low-pressure anatexis, we model the effects of both homogeneous and heterogeneous thinning from normal thickness crust. If the crust thins homogeneously, low-pressure anatectic rocks must undergo marked decompression, such as is recorded in many core complexes. If the crust thins asymmetrically, or if the crust is thin to begin with, anatectic rocks should record an approximate isobaric heating path, such as is required for low-pressure anatexis following prograde metamorphism from the andalusite to sillimanite fields. Kinematic patterns in the crust strongly control individual rock histories, but mantle lithosphere kinematics exert a primary control over the gross thermal evolution toward low-pressure crustal anatexis.

T51A-08 0830h POSTER

Nd-Sr Isotopic and Zircon U-Pb SHRIMP study of the Precambrian Metasedimentary Rocks from the Alashan microcontinent, NW China

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The mainland China geologically consists of three major Precambrian cratons (Sino-Korea, Yangtze, and Tarim) with some microcontinents and fold belts. These cratons and microcontinents are thought to have amalgamated together through geological time, forming intervening fold belts at different geological ages. The Alashan microcontinent is located in the northwestern part of China. To the west, it is truncated by the Altyn faults and is in direct contact with the Tarim craton. It is bounded southerly by the Qilian fold belt and northerly by the Mongolian-Xingan fold belt. It is connected with the Sino-Korean craton along Helangshan fold belt. No relative movement between the Alashan and Sino-Korean craton has occurred since mid-Cambrian period, but their relation in the pre-Cambrian time is not clear. The sedimentary rocks of the Alashan microcontinents have been metamorphosed to quartzites, marbles, schists,

and gneisses under greenschist to amphibolite facies. Thirteen metasedimentary rocks collected from Kaotai, Shandan, and Jingchang were studied with petrographic microscopy and were analyzed for major and trace elements. These samples are characterized by LREE enrichments (100×Chondrite abundance) with negative europium anomalies (Eu/Eu^{*}=0.5-0.7), similar to the post-Archean shales. Besides, their Th/Sc ratios are close to unity and their ϵ_{Nd} values are less than -10. These geochemical characteristics indicate that their major sources were supra-crustal continental materials. U-Pb SHRIMP studies on the zircons separated from the greenschist facies metapelites show that age of the zircons are mostly scattered around 1.8-2.5Ga. This age may correspond to that of the continent-continent collisional event which led to formation of the Columbian supercontinent in the early proterozoic time. Besides, based on the zircon ages, it can be concluded that the Alashan microcontinent may have a closer affinity with the Sino-Korean craton than with the Yangtze craton, for the Sino-Korean craton is characterized by a geological event at 1.8Ga, while the Yangtze craton by a geologic event at 0.7-0.8Ga in their respective tectonic evolutionary histories. Moreover, few zircons are inferred to have a metamorphic age of about 400Ma from the Pb loss, indicating that the Alashan microcontinent might have been reactivated during the lower Paleozoic time.

T51A-09 0830h POSTER

Lithosphere Compartments and Their Dynamics on the Romanian Territory. Seismotectonic Consequences

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Various models for plate tectonics on the Romanian territory were constructed mainly based on geological arguments. The paper attempts to outline plate boundaries based on their geophysical behavior. Complex geophysical investigations were used to document a three-plate tectonic model for the Romanian territory. East European Plate (EEP), Moesian micro-plate (MoP), and the Intra-alpine micro-plate (IaP) are separated by major contacts: Tornquist-Teisseyre (TTZ) compresional zone, Peceneaga-Camena, and the Trans-Getica transform faults. Past to recent dynamics is discussed with emphasize on the consequences of the Black Sea opening. It seems that crust extension related to the W Black Sea basin opening split the MoP into several crustal slivers, which relatively move each to another. After the end of Black Sea evolution, active rifts in SW Arabian Plate could offer present driving forces acting on those compartments and generating normal earthquakes along their wedges. Crust shortening took place in various environments. East Carpathians, crust expelled met the inclined boundary of TTZ and came into an oblique subduction to which peculiarities of volcanism in the southernmost Harghita Mts. seem to be related. South Carpathians, crustal slivers faced the vertical margin of the IaP and provoked a lithosphere buckling, well reflected in the lowest gravity low on the Romanian territory, located in front and not beneath the highest mountains in the country. Within Vrancea active seismic zone, the confined hypocenters location seems to be due to the presence of a continental unstable transform-transform-compression triple junction. The block squeezed between MoP, EEP and IaP wedges was pushed down by tectonic forces driving the three plates. The penetration of a colder lithosphere compartment into the hotter upper mantle led to a thermodynamic disequilibrium. During the temperature accommodation various phenomena such as convective cells, phase transform, and devolatilization add new sources to the intermediate seismicity in the area. Some considerations on the migration of the triple junction are also made. Acknowledgements. Research made subject to the project 177/2003, supported by CERES Program of the Romanian Ministry of Education, Research and Youth.

T51A-10 0830h POSTER

Vertical Velocities of Kyushu Island Using Continuous GPS Observation Data, 1997-2001

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Vertical velocities of Kyushu Island in southwest Japan are calculated using continuous observation of Global Positioning System (GPS) for the period of 01-April-1997 to 31-Dec-2001 when there were no special large events. Although vertical components of the GPS velocities have been seldom applied because of higher noise level than horizontal one, recently Geographical Survey Institute of Japan opens its new version of GPS data with a lower noise level. After plotting the time series of 117 GPS observation data, at the first step we extracted the annual vertical velocity of each observation site. Then using least square prediction method the annual upwelling and/or subsidence rate was calculated in a girded surface. The preliminary results show that (1) The correlation distance of vertical component in Kyushu Island is 82.5 km. (2) In central south part of Kyushu there is an obvious uplifting with the rate of 1.0-1.2 cm/yr due to the magma immigration under a volcanic region called Sakurajima. (3) 4 mm/yr uplifting of eastern part of Kyushu may reflect the activity of western tip of right-lateral Median Tectonic Line (MTL) fault in this area. (4) The subsidence of central part of Kyushu has a coincidence with Beppu-Shimabara Graben (BSG) with a trend of ENE-WSW.

T51A-11 0830h POSTER

Understanding the Mechanics of Strain Partitioning in Frictional Oblique Wedges Using Quantified Analogue Models

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We examine oblique frictional wedges to understand the onset of strain partitioning in the absence of a pre-existing distinct sliver terrane or margin parallel shear zone. Using a series of analogue models, in which we measure the horizontal strain field, we characterize the style of strain accommodation that occurs during the transition from diffuse, obliquely slipping thrust faults to distinct domains of margin normal compression and margin parallel shear during the active accommodation of plate motion. By accurately measuring the surface displacements of a grid of reference points in our analogue models we precisely calculate a velocity field, which is used to calculate shear strain rates and the absolute magnitude of strain. The velocity field is calculated at frequent intervals using a set automated image analysis algorithms in order to discern changes in the style of strain accommodation with growth of the oblique wedge. Using this quantitative analysis technique we investigate how strain is accommodated at a series of linear oblique margins with increasing obliquities to plate motion. We compare these results to a similar model in which the wedge is growing along a margin that is normal to the relative plate motion direction. Our results indicate that in the absence of a pre-existing sliver terrane, an oblique margin governed by a frictional rheology will initially distribute plate motion diffusely on a number of obliquely slipping structures. As the wedge develops, the margin parallel component of plate motion is eventually isolated as shear resulting in bulk strike-slip motion parallel to the margin, with more shear near the rear of the deforming wedge, close to the edge of the overriding plate. The shear zone becomes narrower with increasing obliquity as the margin parallel strain rate increases. At small obliquities, the margin parallel component of plate motion results in along strike shearing of the wedge internally, from the deformation front to the edge of the overriding plate. With an increase in plate motion obliquity, and the resulting margin parallel shear, there is a transition in the style of strain accommodation into zones of distinct margin parallel shear at the rear of the wedge and margin normal compression at the front of the wedge. As a result, at higher obliquities, the analogue prism, from the overriding plate to just before the deformation front, moves nearly as a coherent sliver and results in compression at the front of the prism that is very close to pure dip-slip. In these experiments, although there is no preexisting weak zone, strain tends to be localized on a distinct set of structures as relative plate motion obliquity increases. Once a margin parallel shear zone develops the wedge more efficiently partitions strain at the deformation front as it continues to grow.

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Tehuantepec Ridge: a compressional structure?

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Structural and morphological features observed in the bathymetry of the Tehuantepec ridge and fracture zone (TR) comprise: the inverse faults orthogonal to TR, the difference in bathymetry and a documented age difference (∼10-12Ma) between the two compartments separated by TR and oblique trended features at the end of the TR. These characteristics might be explained as a strike-slip compression associated with a plate motion change of the southeastern part of TR, which began about 12.4 Ma. The assessment of the age of the lithosphere at the time of bathymetric loading of the TR is deduced from the analysis of the experimental admittance and the elastic thickness Te. We have computed the admittance, which is interpreted in terms of isotropic elastic plate thickness. A model with a Te of 10±5 km fits well the observed admittance. The shape of the admittance (low values at low wave-numbers) suggests that TR is isostatically compensated. Using a diagram of the Te versus the age for a cut-off temperature of 450°C, the age of ∼15±10 Ma was obtained for the oceanic lithosphere at the time of TR onset. The age of TR formation inferred from structural and morphological features observed in the bathymetry of TR is in good agreement with the age inferred from the elastic thickness estimation.

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The Mysterious Southern Torque

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Something weird happened to twist the southern hemisphere out of alignment with the northern, as evidenced by the positions of the mountain ranges of North and South America, the Atlantic MAR, and the closure of West Africa to North America - all smooth were the torque reversed. What happened, and when, and why? We identify a number of global “cracks” of almost exactly the same length and direction, with some, even more peculiarly, turning the same angle, and proceeding an equal distance in the new direction. The Emperor-Hawaiian chain, the Louisville chain and the west coast of North America, as examples, are essentially parallel. Their northerly legs follow the angle of the axis of orbital ellipse. But then they all make equal 45 degree easterly bends, to 17.5 NW, and continue on, still parallel, for very similar distances. It is the same at the north coast of South America, and the mid-section of the MAR from 46W to 12W. It is the distance from the Cameroons to Kenya, from the south end of the Red Sea to the SE Indian Ridge at the Nema Fracture zone, from west to east of the Nazca plate. . . What is all this? Coincidence? Seeing things? Researchers have attributed plate motion or hot spot motion or both or absolutely none, to all of the above. Geophysicists have dated the surfaces from Archean to Pleistocene by all possible scientific means, certainly no possible correlation can be made. Yet we postulate the physical reality can be demonstrated. It is so global a phenomenon that it is well beyond what a hot spot or a plate could do. Even a really tremendous impact would have trouble making such precise geometric arrangements. So what is it - perhaps the angle of rotation, or the inertia of northern hemisphere mass above the geoid? And if so, then, what changed it? It would seem that some huge imbalance occurred. Suppose the whole bottom blew out of the southern hemisphere, and the center of mass drastically altered. Suppose some unknown universal force changed our composition - magnetic or other. Were the magnetic poles ever the elliptic axis? What this world needs is a few more outrageous ideas.

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