related to EVT3, and makes it difficult to identify the earthquake's contribution to the observed deformation. Because of this, the geodetic mechanism for EVT3 is less well constrained than the mechanism for EVT15. However, both the seismic and GPS data prefer a non-double-couple mechanism for EVT3. The mechanism of this earthquake is clearly anomalous, and might be related to the interaction between an inflational source and a faulting source.

### S52I-05 1700h

## New Inferences on the Campi Flegrei Caldera Structure from microearthquakes P- and S- delay time tomography

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The recently upgraded dataset collected during the 1982-1984 bradyseismic crisis of the Campi Flegrei caldera has been used to image its shallow structure by a three-dimensional delay-time tomography. Data selection provided 2500 P- and 2027 S- weighted pick times from 403 well located earthquakes. Data have been modeled by using a tomographic method based on an accurate finite-difference travel-time computation which, simultaneously inverts P- and S- first-arrival times for both velocity and hypocenter locations. We explored the dependence of results on the grid parameterization as well as on the initial velocity model, through a statistical study of the final solution inferred from 400 randomly sough initial 1-D models. The interpretation of the retrieved P- and S- wave velocity models and of the deduced Vp/Vs and Vp*Vs images has been supported by rock physics modeling of a laboratory dataset available in this area. This allowed us for mapping zones with different fluid saturation and fracture accruement down to 6 km depth. Between the surface and 3 km depth, the slighter increase of Vs as a function of depth compared with Vp seems to account for the high Vp/Vs and low Vp*Vs anomalies. Anomalies are also spatially correlated to the seismicity occurring at this depth. These seismic signatures suggest that the shallow caldera structure is formed by fractured and brine bearing formations. A nearly circular shaped Vp*Vs anomaly characterizes the deeper structure between 3 km and 5 km. Its inner part shows low values in which seismicity also occurs and a low Vp/Vs superimposes. Both low Vp and Vs anomalies are responsible for the aforementioned low Vp*Vs and Vp/Vs features: we are more inclined to interpret the deeper part as a fractured medium having partial or predominant steam saturation. The low Vs values characterizing the inner part of the caldera between 1 km and 4 km suggest that fluids might stand overpressured.

### S52I-06 1715h

## Along-Arc Variation in the Magma Distribution Beneath NE Japan Inferred From Travel Time Tomography

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Volcanoes in active plate margins are generally considered as being regularly spaced along the strike of the arc [e.g., Marsh, 1979, JGR], and this has been used to derive constraints on the characteristics of the deep source of magma and on the mechanisms of magma ascent. However, Bremond d'Ars et al. [1995, JGR] investigated the distribution of volcanoes in 16 active plate margins and concluded that volcanoes are randomly distributed. Recently, Tamura et al. [2002, EPSL] investigated spatial distribution of Quaternary volcanoes in the NE Japan arc and pointed out that Quaternary volcanoes in the NE Japan arc are grouped into 10 volcanic clusters striking transverse to the arc. They have an average width of 50 km, and are separated by 30-75 km wide gaps. Tamura et al [2002] proposed that these observations are surface manifestations of locally developed hot regions having the form of inclined, about 50 km wide fingers extending from >150 km depth below the back-arc region to approximately 40 km depth below the volcanic front within the mantle wedge. To confirm this interpretation by Tamura et al. [2002], we conducted a specialized tomographic inversion of S-wave velocity structure of the mantle wedge beneath NE Japan. Only S-wave velocities of the mantle wedge portion were estimated by using the same data set of our previous study [Nakajima et al., 2001, JGR] but with those of the other portions being fixed. Obtained images have higher spatial resolutions of 10 km in both the horizontal and vertical directions. As predicted by Tamura et al. [2002], velocity decrease in the inclined low-velocity zone has an along-arc variation and is locally large below the areas where Quaternary volcanoes are clustered. In other words, the hot mantle fingers have extremely low S-wave velocities. Moreover, deep, low-frequency microearthquakes are also clustered above such locally low velocity areas. Prominent S-wave low-velocity zones in the mantle wedge, distribution of Quaternary volcanoes at the surface, and deep, low-frequency microearthquakes are closely correlated in space, suggesting that the spacing of Quaternary volcanoes at the surface is determined by along-arc variation of melt contents in the low-velocity zones in the mantle wedge.

### S52I-07 1730h

## Seismic Detection of Sediment Interface Beneath the Moat Regions of the Valles Caldera, New Mexico

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We examine seismic refraction data from the Jemez Tomography Experiment centered over the Valles Caldera, New Mexico. The Valles Caldera formed 1.2 Ma with a plinian eruption of the Bandelier Tuff and was preceded 1.6 Ma by the formation of the Toledo Caldera. After the initial collapse of the caldera, a resurgent dome formed in the central region bordered by subsided caldera moats, or valleys, along the periphery of the ring fracture zone. Six active seismic sources were used to analyze the shallow (<6 km) subsurface beneath the caldera. P-wave and P-S converted phase arrival times are identified and the difference between these traveltimes is used to compute the thickness of the caldera fill material. The most prominent secondary arrivals are centered on two moats within the region: the Valle Grande and the Valle San Antonio. These regions are free from the rhyolitic extrusions that occupy most of the caldera area and are believed to contain the most fill material. We interpret these secondary features as P-S conversions from a subsurface interface between 1 and 2.5 km depth. Previous work in the area has revealed a cyclic history of lake formation within the Toledo/Valles caldera complex throughout its 1.6 million year history. The strong secondary arrivals located beneath the moat regions denote lacustrine sediment interfaces, the boundary between lacustrine sediments and volcanic breccias, or the boundary between lacustrine sediments and the roof of the subsided caldera block.

### S52I-08 1745h

## High Resolution Waveform Tomography at a Groundwater Contamination Site: Surface Reflection and VSP Datasets

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We have applied a form of waveform tomography (Pratt et al., 1998) to datasets from a vertical seismic profile (VSP), coincident 2D reflection, and a 3D surface dataset from Hill Air Force Base (HAFB), Utah. The transmitted waves recorded at depths in the VSP data constrain deep structures better than the surface data. However, surface data with large offsets that are not contaminated by ground roll provide good depth-constraint on seismic phases such as the refraction and reflection wavefields. We have applied the waveform tomography to 45 36.0-meter-long 2D surface profiles that were extracted from the 3D dataset. The profiles are almost perpendicular to the surface spread of the VSP experiment. Travel time tomography applied to the profiles using first arrival picks provides initial velocity models for the waveform tomography. Source signatures for individual shots are inverted at each iteration of the waveform tomography. Seismic velocity increases from $\sim 300.0m/s$ at the surface to $\sim 1600.0m/s$ at 16.0m depth. The 11 profiles which intersect the VSP profile correlate reasonably well with the VSP velocity model. The cross-sectional geometry of a paleo-channel, the structural trap containing most of the DNAPLs, can be identified in each of the final velocity models. The combination of the cross-sectional images of the paleo-channel from waveform tomography provides a 3D perspective on velocity structure and the channel with relatively high vertical and lateral resolution (∼1.5m).

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## S52J MCC: 3009 Friday 1600h

## African Superswell Province: From Core to Crust IV *(joint with T, V)*

*Presiding:* **N O Mariita,** University of Texas at El Paso; **M J Fouch,** Arizona State University

### S52J-01 1600h

## Mantle plumes as cause of long-lasting cratonic uplift implications for southern Africa

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Active mantle plumes are the prime suspects for midplate uplifts, like the Hawaiian swell. The question arises as to whether the effects of more ancient plumes can cause long-lasting uplifts like the swell in Southern Africa. Starting plume heads are unlikely to do this. First, the plume material flows laterally and ponds beneath regions of thin lithosphere. Only tens of kilometers of plume material remain beneath the cratonal keels. Second the ponded plume material suppresses secondary convection by having a stable boundary at its base. Heat continues to flow out of the top of the lithosphere. The net imbalance of heat flow in a column of material leads to subsidence. Even after the plume material has all cooled to the mantle adiabat, secondary convection supplies less heat flow to the lithosphere than is lost upward by conduction. The craton returns to its original thermal structure on a time scale of less than 200 m.y. In contrast, plume tails can linger for a long time beneath cratons and eventually raise the conductive geotherm into equilibrium with plume material. A lingering plume tail at ca. 80-90 Ma is a viable mechanism for the Southern African swell.

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### S52J-02 1615h

## A Preliminary Analysis of Crustal Structure Variations Along the Ethiopian Rift

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The EAGLE (Ethiopia Afar Geoscientific Lithospheric Experiment) is an ambitious effort that involved a 3-phase seismic experiment that was conducted in January of 2003 and was followed by a magnetotelluric project and a variety of supporting efforts

that collectively provide a diversity of data for integrated analysis. The third phase of the seismic experiment featured the deployment of 1100 seismic instruments during a controlled source seismic project involving 20 seismic charges being fired into one 450km cross-rift profile (Profile 1), one 450km axial profile (Profile 2), and a dense 2-D array of instruments in a 150km diameter circle around the intersection of these profiles. This intersection is centered on the magmatically active Nazret region in the Main Ethiopian rift valley. Crust and upper mantle velocity models are being derived from these data and will be used to provide estimates of total crustal thinning across and along the rift, to assess the role of basement in the location of major faults and magmatic segments, and to determine whether significant underplating takes place during the syn-rift stage. Our group is working on the Line 2, which follows the axis of the rift from the southern Afar region southward for over 400 km into the main Ethiopian rift. Along this line, recording stations were deployed at an interval of 1km, and sources were placed at an interval of 50km. The data quality is generally very good although cultural noise was surprisingly high in one region. Our preliminary interpretation shows that the crust is about 25 km thick in southern Afar about 35 km thick in the main Ethiopian rift. The low-velocity layer (Vp < 4.0 km/s) of volcanics and sediments at the surface is surprisingly thick ( 5 km) along most of the profile, but the velocity structure appears to be continental otherwise.

## S52J-03 1630h

### Crustal Velocity Structure Across the Main Ethiopian Rift

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As part of the project EAGLE (the Ethiopia Afar Geophysical Lithospheric Experiment) a 400 km NW-SE wide-angle reflection/refraction seismic profile, was recorded across the Main Ethiopian Rift in January 2003. Instruments were deployed at a nominal spacing of 1 km and consisted primarily of single component Reftek “Texan” recorders with 3 component Guralp CMG-6TD seismometers deployed every 4 - 5 km. Eight in-line borehole shots and eleven fan shots of between 1 and 2 tonnes were recorded over a 4-day period. The data show good energy propagation along the entire length of the profile with a wide coverage of Pg, PmP and Pn phases plus at least one intra-crustal reflected phase. Considerable variation is observed in the amplitude of the reflected Moho and intra-crustal phases across the entire length of the profile. We present preliminary 2D velocity models of the lithospheric structure of the rift from the modelling of this data using both tomographic and raytrace modelling methods. These show a low velocity surface layer across the length of the profile with a clear graben-like structure beneath the centre of the Rift. This layer is likely to represent layered basalts and Mesozoic sediments beneath the plateau region and Quaternary sediments and volcanics within the Rift. An approximately 38 km thick crust, thinning slightly beneath the Rift and including at least 1 intra crustal reflector is also modelled.

## S52J-04 1645h

### 40 Million Years of Mafic Volcanism in Turkana, Kenya: Geochemical Insights

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The Turkana region in northern Kenya is the most highly extended portion of the East African Rift System. At least three superposed rifting episodes have affected this area since the Cretaceous, resulting in a highly attenuated crustal section. Mafic volcanism commenced in Turkana over 40 Ma and continues through the present. The geochemistry of Turkana mafic lavas appears dominated by contributions from an asthenospheric source region throughout this time period, with recognizable but volumetrically lower input from the continental lithosphere. Mantle plume inputs cannot be identified uniquely in this area but cannot be ruled out. Major element compositions of mafic lavas, back-corrected for olivine fractionation, indicate substantial shallowing of melt generation depth from Tertiary through the present. Concomitant changes in Ce/Y and Zr/Nb support this model, though all melts appear to be derived from clinopyroxene-rich spinel peridotite. Values of Ce/Pb, La/Nb, Nb/U differ only slightly between Tertiary and Quaternary lavas, and all are within the ranges expected for asthenosphere-derived basalt for most samples. Tertiary Turkana mafic lavas have Sr and Nd isotope values that overlap those of Quaternary Turkana basalts (0.7031-0.7035, 0.5128-0.5130). Pb isotope signatures of Turkana lavas have remained homogeneous over the past 3.5 Ma and are consistent with contributions from a deep mantle (e.g., FOZO or C) source. In contrast, late Eocene through Oligocene mafic lavas from Kajong and Porr volcanic centers have Pb isotope values that are more highly radiogenic than the Quaternary Turkana lavas, suggesting input from a lithospheric source region. The temporal geochemical changes observed at Turkana contrast with those seen in southern Ethiopia less than 100 km to the north. Most importantly, trace element and isotopic data require southern Ethiopian basalts of all ages to reflect primarily lithospheric melting. In addition, the radiogenic Pb signatures observed at Turkana 17-40 Ma are found in Ethiopian basalts 11-19 Ma but not 35-45 Ma, making it possible to determine a rough chemical stratigraphy of the regional lithosphere.

## S52J-05 1700h

### Structure of the Lithospheric Keel Beneath the Tanzania Craton From the Joint Inversion of Receiver Functions and Surface-Wave Dispersion

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The Tanzania Craton is a segment of old continental lithosphere that sits in the midst of the southward-propagating East African Rift System. This is a unique tectonic setting in which the lithospheric keel underlying the craton may be in contact with hot mantle material, and interesting questions regarding cratonic stability (such as the degree of erosion or disruption of the keel by the upwelling mantle) remain. In this study, we present S-wave velocity models beneath the 1994-95 Tanzania Passive-Source Seismic Experiment stations, which covered much of the craton and parts of the surrounding mobile belts. The models have been obtained by combining receiver functions and fundamental mode surface-wave dispersion velocities in a joint inversion for subsurface velocity structure. The combination bridges resolution gaps among the data sets and provides better constrained images of the subsurface than either of the individual data sets alone. Preliminary inversion results show the presence of a prominent low velocity zone (LVZ) at 150-200 km depth when sampling subsurface structure in an EW direction, suggesting disruption of the continental lithosphere. When the subsurface is sampled in a NE-SW direction, however, the LVZ disappears and a high-velocity sub-craton lithosphere is observed, suggesting that the craton is underlain by an undisrupted lithospheric keel. The observed azimuthal differences in deep structure may be reconciled by the incorporation of 3D effects in the base of the lithosphere or anisotropy across the base of the lithosphere, perhaps providing clues to present or fossil flow in the region.

## S52J-06 1715h

### Upper Mantle Seismic Velocity Structure beneath East Africa and the Arabian Peninsula

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The origin of Cenozoic tectonism in East Africa and the Arabian Peninsula remains enigmatic. Previous studies suggest that the existence of slow seismic velocities, that may extend into the lower mantle, are related to the tectonism. To further evaluate the origin of the tectonism, we investigate the depth extent of the anomalous seismic velocities. Using data collected from IRIS/PASSCAL broadband seismic experiments and permanent stations located in East Africa and the Arabian Peninsula we measure surface wave group velocity dispersion curves and tomographically invert them to constrain crustal and upper most mantle seismic velocities. Additionally, we use P and S wave body wave tomography to examine the upper mantle seismic velocity structure beneath Ethiopia. The Rayleigh and Love wave group velocities maps that we computed show the major tectonic features in the region. The short period maps (10-40s) resolve crustal features such as sedimentary basins, differences between continental and oceanic crust, and regions of crustal thickening and thinning. Longer period group velocity maps (50-80s) reveal anomalously slow velocities in the upper mantle beneath rifted and tectonically active regions, while also resolving fast, stable features like the Tanzania Craton. Though surface wave data can resolve lithospheric structure, body wave data is needed to resolve deeper structure. Results from the body wave tomographic study beneath Ethiopia shows a low velocity zone located in the upper mantle beneath the Afar triangle and rifted portion of the country. Additionally, the western half of the Ethiopian Plateau was underlain by slower seismic velocities then beneath the eastern half of the Plateau. Though the low velocity zone appears to extend into the transition zone, there is significant vertical smearing in our results, and resolution tests suggest that the low velocities are confined to the depths shallower than 400 km.

## S52J-07 1730h

### Analysis of the Junction of the East African Rift and the Cretaceous-Paleogene Rifts in Northern Kenya and Southern Ethiopia

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The East African rift (EAR) is a Tertiary-Miocene system that extends from the Middle East, through East Africa, to Mozambique in southern Africa. Much of the present information is from the Ethiopian and Kenyan parts of the rift. Several characteristics of the EAR such as rift-related volcanism, faulting and topographic relief being exposed make it attractive for studying continental rift processes. Structural complexities reflected in the geometries of grabens and half-grabens, the existence of transverse fault zones and accommodation zones, and the influence of pre-existing geologic structures have been documented. In particular, the EAR traverses the Anza graben and related structures near the Kenya/Ethiopian border. The Anza graben is one in a series of Cretaceous-Paleogene failed rifts that trend across Central Africa from Nigeria through Chad to Sudan and Kenya with an overall northwest-southeast trend. In spite of a number of recent studies, we do not understand the interaction of these two rift systems. In both Ethiopia and Kenya, the rift segments share some broad similarities in timing and are related in a geographic sense. For example, volcanism appears to have generally preceded or in some cases have been contemporaneous with major rift faulting. Although, these segments are distinct entities, each with its own tectonic and magmatic evolution, and they do connect in the region crossed by the Anza graben and related structures. In our present study, we are using a combination of recently collected seismic, gravity and remote sensing data to increase our understanding of these two segments of the EAR. We hope that by analysing the satellite data, the variety and differences in the volume of magmatic products extruded along in southern Ethiopia and northern Kenya will be identified. The geometry of structures (in particular, those causing the gravity axial high) will be modelled to study the impact of the older Anza graben structural trends with the younger EAR. For example there is significant crustal thinning in the Lake Turkana area of the northern Kenya segment of the EAR system. In regard to the recent EAGLE experiment in Ethiopia, we are ivestigating if the transition from relatively thick crust ( 40 km) to thinned, rifted crust is as abrupt in Ethiopia as it is in Kenya.

**S52J-08 1745h**

### Mantle Seismic Structure Beneath Southern Africa

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In this study, we examine mantle seismic structure for a broad region beneath southern Africa. The goal of this work is to provide detailed constraints regarding the relationship between surface geology and tectospheric structure beneath southern Africa and their implications for craton formation and evolution. We also characterize deeper mantle structure beneath the region to provide new constraints on structural variations between the tectosphere and mid-mantle. Waveform data for this analysis were recorded on an 82-station broadband seismic array located in South Africa, Zimbabwe, and Botswana. The complete array has a footprint of $\sim$1 million km$^2$, and was one component of the multidisciplinary Kaapvaal Project conducted by the Carnegie Institution of Washington, MIT, and several southern African academic institutions and industry collaborators.

We present results of body wave tomography for both P- and S-waves using a nonlinear inversion technique that determines relative velocity perturbations across the study region. Our results indicate P-wave velocity variations of $\sim\pm1.2\%$, and S-wave velocity variations of $\sim\pm1.6\%$ that are similar in lateral and depth distribution to P-wave velocity variations. The tomographic images provide clear evidence of mantle structures that mimic the dominant surface geology features across southern Africa. Specifically, a thick ($\sim$250-300 km) mantle keel exists beneath the Kaapvaal craton; a slightly thinner ($\sim$225-250 km) keel exists beneath the Zimbabwe craton and parts of the Limpopo mobile belt. No subtectospheric low velocity zone exists across the region. These results are consistent with previous surface wave analyses for the region [Ritsema and van Heijst, Geology, 2000], as well as more recent surface wave analyses using data from the Kaapvaal Project seismic waveform dataset [A. Li, pers. comm.]. Additionally, lower than average cratonic mantle velocities exist at smaller scales beneath the surface expression of the Bushveld Complex, a 2.05 Ga layered mafic intrusion. These reduced velocities may be due to mantle refertilization during the Bushveld intrusion, or they may be caused by a thermal perturbation of more recent origin, perhaps related to the Karoo magmatic event. Finally, we observe a well-resolved, concentrated zone of anomalously lower than average velocities at $\sim$1000 km and deeper beneath the Kaapvaal craton. We suggest that this region is likely related to previously observed low velocity deep mantle associated with the South African superplume.

URL: http://www.ciw.edu/kaapvaal

## S52K MCC: 3011 Friday 1600h

## Collateral Damage: Earthquake Source Characteristics II *(joint with T)*

***Presiding:*** **S Baher,** U.S. Geological Survey**; J Ampuero,** Princeton University

**S52K-01 1600h**

### Seismic Constraints on Mechanisms of Deep Earthquake Rupture

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Observations of the depth distribution of seismicity suggest that several mechanisms cause deep earthquakes. Cold subducting slabs exhibit a broad peak in seismicity between 300 and 530 kilometers depth that is best explained by transformational faulting of metastable olivine. Cumulative seismic moment release increases sharply at about 530 km depth in both cold and warm slabs, implying that events deeper than this are controlled by an equilibrium rather than a metastable phase change, which would be temperature dependent. This, together with the observation that deep seismicity predominates near the garnet-rich upper boundary of the subducting plate (former oceanic crust), suggests that the transformation of garnet to perovskite, which may release considerable water, is integral in the cause of earthquakes deeper than 530 km, where most deep earthquakes occur.

**S52K-02 1615h**

### Very Deep Earthquakes Occur Above the Depressed Top of the Lower Mantle

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We present unequivocal evidence that very deep earthquakes near 690 km still occur above the "660-km" discontinuity which separates the lower mantle and the transition zone. The strongest evidence comes from two recent earthquakes that occurred at great depths of 688$\pm$10 km and 693$\pm$10 km along the Tonga and the Kurile-Kamchatka subduction zones, respectively. The focal depths are constrained by relative timing (with respect to direct *P* and *S* arrivals) of *pP*, *sP*, and *sS* phases along paths unaffected by subduction or *pwP*. Then we directly determine the **relative** position of the foci and the "660-km" discontinuity based on the principle that triplicate arrivals are strong from a source located above a discontinuity, but such arrivals would be completely absent for a source located just below the discontinuity. We observe strongly triplicate *P* and *S* waveforms that exhibit distinct move-outs across broadband (high-resolution), permanent seismic arrays at regional distances (7$^\circ$-20$^\circ$). Thus these earthquakes at depths near 690 km must have occurred above a strong discontinuity. We matched the observed waveforms with synthetic seismograms and the results show the prominent contrast in seismic wave speeds across the discontinuity is consistent with that across the "660-km" discontinuity of the average Earth. Thus the "660-km" discontinuity is apparently deflected downward by about 5 km farther below the hypocenters, reaching a depth of about 695 km. Downward deflection of the "660-km" discontinuity below earthquakes as deep as 690 km implies that the Clapeyron slope associated with the "660-km" discontinuity is large and the necessary conditions to trigger deep earthquakes exist only above the lower mantle.

**S52K-03 1630h**

### The mechanism of great Banda Sea earthquake of 01 February 1938: Applying the method of Preliminary Determination of Focal Mechanism to a historical event

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A moment tensor solution is derived for the 1938 Banda Sea earthquake, one of the largest events for which no definitive focal geometry has been published. We apply the PDFM method, which consists of inverting for a moment tensor using exclusively the spectral amplitudes of mantle waves, while discarding the phase information affected by uncertainties in relative timing between historical records. From a dataset of 17 records at 7 stations, we obtain a robust solution, featuring a very large moment of 8.4*10**28 dyn-cm, the centroid depth being constrained at 60 km by minimizing the r.m.s. residual of the inversion. The method involves an inherent two-fold 180-deg. indeterminacy on strike and slip, which is lifted by the polarization of long-period body waves read individually on original records, resulting in a mostly thrust-faulting mechanism (strike: 276 deg.; dip: 63 deg.; slip: deg.). This confirms the event as ranking among the ten largest moments ever published. Its deeper than normal focus agrees well with the minor level of reported damage, and with the generation of a relatively benign tsunami. The 1938 event shares its compressional axis with that of the smaller and deeper 1963 shock to the Southwest, which probably expresses coherence in the regional contortion of the subducting Australian plate lithosphere.

**S52K-04 1645h**

### Rupture Characteristics and Aftershocks of the July 15, 2003 Carlsberg 'H' (Indian Ocean) $M_w$ 7.6 Earthquake

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The occurrence of a $M_w$ 7.6 earthquake near the Carlsberg ridge (15 July, 2003) provides valuable information about earthquake rupture processes in oceanic lithosphere, which are not well understood, and the distributed deformation of the India-Australia plate. The earthquake had a strike-slip mechanism opposite to that of the transform faults on the ridge, and appears to have ruptured a fracture zone (designated as 'H' by *Royer et al.*, 1997) within the India-Australia composite plate. We examine the rupture characteristics of this earthquake using the full spectrum of seismic radiation. Inversion of the body waves indicates rapid rupture propagation toward the NE, away from the Carlsberg Ridge, for a distance of $\sim$200 km. The average rupture velocity is well constrained and is $\sim$3.6 km s$^{-1}$. The total source duration is $\sim$60 s; however, nearly all of the moment release occurs in the last 30 s. The age of the lithosphere in the area of largest moment is release is 10-15 Ma. The body waves can be well fit with a simple rupture model and no jump of fracture zones is required, as has been suggested for some oceanic earthquakes (e.g., *McGuire et al.*, 1996). The source process is very similar to the well-studied 1994 $M_w$ 7.0 earthquake along the Romanche transform in the equatorial Atlantic (*Abercrombie and Ekström*, 2001). We also analyze the aftershock distribution using multiple-hypocenter relocation techniques and moment-tensor analysis using intermediate-period surface waves. Only 15 aftershocks ($M > 4.5$) are listed in the USGS catalog, which is typical of large oceanic earthquakes (e.g., *Boettcher and Jordan*, 2001). Moment tensors obtained from five of the aftershocks show a diversity of focal mechanisms. We interpret a cluster of aftershocks located at $\sim$1$^\circ$ S as representing extension which results from the stress field of the mainshock at the end of the rupture. This interpretation is consistent with the 200-km rupture length inferred from body waves. The focal mechanism of the July 15 earthquake indicates N-S extension within the oceanic lithosphere east of the Carlsberg Ridge. *Royer and Gordon* (1997) interpreted this extension as part of the deformation associated with a diffuse plate boundary between the Indian plate and a hypothesized Capricorn Plate. They placed the northern boundary of the diffuse region of deformation near 7$^\circ$ S. The occurrence of the July 15 earthquake indicates this diffuse boundary is wider than previously believed.

**S52K-05 1700h**

### Spatial Variation of Aftershock Stress Drops in the focal Area of the 2000 Western Tottori Earthquake (Mw=6.6)

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Stress drop is one of key parameters for understanding the source of an earthquake. Many researchers have been interested in the distribution of static stress drop on the fault plane of large earthquakes [e.g. Miyatake, 1992; Mikumo and Miyatake, 1995]. However, the relationship between the slip/stress drop distribution on the mainshock fault plane and spatial distribution of aftershock stress drops has not been studied well.
We estimated stress drops of 450 aftershocks of the 2000 Western Tottori earthquake using seismograms recorded at nearby NIED Hi-net stations. Observed velocity spectra are first corrected for radiation pattern obtained from focal mechanisms. Then, the optimal

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