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In Summer 1998, a 400 km long seismic refraction profile (INDEPTH III) was shot in Central Tibet. Apart from recording the signals of 11 shots along the line, the stations also recorded a number of local earthquakes more or less in the extension of the line. Record sections and travel time data from both shots and earthquakes were compiled and interpreted jointly. The following peculiarities are observable: (1) All southern shot points and earthquakes exhibit a sudden offset or time delay in the travel time curves for crustal phases ($P_g$) at about the latitude of the Bangong-Nuijang-Suture (BNS). (2) Strong $P_n$ branches, but no $P_M P$ are visible in the earthquake records. (3) Neither $P_n$ nor sub-critical $P_M P$ are observed in the shot records but some post-critical $P_M P$ phases can be identified. The first observation can be explained by a vertical low-velocity zone near the BNS with a steep northerly dip and reaching to at least 35 km depth. The other two observations indicate the presence of a seismic velocity gradient between 55 and 70 km depth. A gradient zone rather than a first order boundary at the Moho was also observed in Southern Tibet and beneath the Altiplano in the Andes and was predicted by previous experimental investigations of the gabbro-eclogite transformation for areas with strongly thickened crust such as Tibet. In contrast to southern Tibet, the travel time data do not show any evidence of a mid-crustal layer of low P velocities; P velocities in the lower crust are low.

## T51B-1147 0830h POSTER

### Timing and Rates of Quaternary Normal Faulting in Central Tibet

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In the tectonically active NNE-striking Shuang Hu graben in central Tibet, significant extension by normal faulting started by 13.5 Ma, but probably not before 20 Ma. The asymmetric graben has an estimated vertical offset of 4-7 km along the structurally dominant western boundary-fault zone, suggesting a mean vertical offset rate between 0.2 and 0.5 mm/yr.

Along a transect in the SW part of the graben, the fault zone is ca. 2 km wide and comprises 4 major normal faults that appear to be younger from W to E. The easternmost and youngest faultthe only one with a pronounced scarpprogressively offsets several Quaternary river terraces. The well-preserved surfaces of the two youngest terraces are vertically offset by 1.2 m and 14.1 m. Using TIMS U-series, we dated ca. 50 samples consisting of milligram-size dense portions of pedogenic carbonate pebble-rinds. Mean oldest inner-rind ages for the two terraces are 13 ±1 and 234 ±9.4 ka. Favorable 238U/232Th ratios (median =29) and preservation of micro-stratigraphic order indicate these ages are reliable. Consideration of rind growth-rates and the interval needed to form datable rinds suggests minimum ages of 15 and 236 ka for deposition of the two terraces. This implies vertical displacement along this fault at an average rate of 0.08 mm/yr during the last ca. 15 ka, and 0.06 mm/yr during the last ca. 240 ka.

Although additional Quaternary displacement along the western graben margin may have occurred, either along older faults or more broadly distributed, we consider it unlikely that these could account for the discrepancy between the Quaternary and longer-term rates. It thus seems that during the late Quaternary, normal faulting along this graben margin has been slower than during its earlier evolution. If upper crustal E-W thinning is driven by increased potential energy of elevated crust, our data support a scenario where the potential energy is decreasing, and imply that the plateau may have surpassed its maximum elevation.

## T51B-1148 0830h POSTER

### Cretaceous to Tertiary Vertical-Axis Tectonic Rotations of Northeastern Tibet From Preliminary Paleomagnetic Results

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The tectonic development of the Himalayan-Tibetan orogen has a wide range of interpretations. It is often described as propagating northward with its most recent outgrowth in the northeastern part of the orogen. As part of a multidisciplinary project to constrain the kinematics of deformation in northeastern Tibet we carried out paleomagnetic sampling during the summer of 2002 at 16 localities (134 sites) within two general areas: the Xining-Lanzhou basin and the westernmost Qinling Shan. In both areas we also sampled for magnetostratigraphy to constrain the age of basin deposition. Stepwise thermal demagnetization of pilot samples yields the following preliminary results (Locality ID; Location; Age; vertical-axis rotation (clockwise >0)):

Westernmost Qinling Shan:
DC; $N34.1^{\circ}$; $E104.5^{\circ}$; Lower Cretaceous; 21.1 ± 5.9°
ND; $N34.1^{\circ}$; $E104.7^{\circ}$; Paleogene; 23.2 ± 7.2°
NY; $N34.0^{\circ}$; $E104.7^{\circ}$; Paleogene; 22.1 ± 27.6°
HC; $N35.2^{\circ}$; $E104.0^{\circ}$; Eocene-Oligocene; 20.6 ± 8.9°
LX; $N34.9^{\circ}$; $E104.4^{\circ}$; Eocene; 37.8 ± 13.6°
WF; $N34.9^{\circ}$; $E104.8^{\circ}$; Miocene(?); 2.0 ± 8.1°
Xining-Lanzhou basin:
XN1; $N36.6^{\circ}$; $E101.9^{\circ}$; Upper Jurassic-Lower Cretaceous; 24.0 ± 7.9°
XN2; $N36.6^{\circ}$; $E101.9^{\circ}$; mid Cretaceous-Eocene; 15.2 ± 9.8°
RS; $N36.5^{\circ}$; $E101.2^{\circ}$; Lower Cretaceous; -21.3 ± 6.0°
SC; $N36.4^{\circ}$; $E102.1^{\circ}$; Lower Cretaceous; 2.3 ± 7.7°
XI; $N36.7^{\circ}$; $E101.8^{\circ}$; Oligocene; -1.1 ± 5.2°
XG; $N36.3^{\circ}$; $E101.8^{\circ}$; Miocene; 3.5 ± 9.1°

Westernmost Qinling Shan results indicate that the majority of the area has undergone ~20° clockwise vertical-axis (V-A) rotation since Paleogene time. Results from the Xining-Lanzhou Basin are more complex, suggesting a combination of regional and local deformation. No regional (V-A) rotation of the Xining-Lanzhou basin since Late Cretaceous time is suggested by results at SC, XI, and XG. However, Tertiary local (V-A) rotations are suspected at XN1 and XN2 collected in the footwall of a north-trending normal fault and at RS collected near the northwestern termination of the Laji Shan pop-up structure. Accurate age and structural constraints on these interpretations are expected from other aspects of the project, including magnetostratigraphy, palynology, basin analysis, structural mapping and thermochronology (see Horton et al., this volume).

URL: http://www.geo.arizona.edu/~/gdn

## T51B-1149 0830h POSTER

### Improved Age Constraints for Mesozoic and Cenozoic Basin Development in Northeastern Tibet Based on Magnetostratigraphy and Palynology

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Kinematic restorations of deformation across the Tibetan plateau rely on age interpretations of regionally distributed Mesozoic and Cenozoic nonmarine strata. However, distinguishing Jurassic, Cretaceous, Paleogene, and Neogene strata in Tibet has proven very difficult due to broad lithostratigraphic similarities and a general lack of diagnostic mammalian fauna. As part of a regional multidisciplinary project in northeastern Tibet ($34-37^{\circ}$N, $101-105^{\circ}$E), we report new magnetostratigraphic and palynological data for a series of stratigraphic successions ranging in age from Late Jurassic to mid-Tertiary. The new age data are combined with sedimentologic and provenance analyses to reconstruct the depositional histories of the Xining-Lanzhou, Dangchang, and Zhangxian basins. In the regionally extensive Xining-Lanzhou basin (~30,000 $km^2$), long-term (>100 Myr) deposition of an ~1-km-thick, fine-grained succession is recorded by an assemblage of Late Jurassic to mid-Tertiary palynomorphs and an intermediate stratigraphic interval exhibiting normal-polarity magnetizations which we attribute to deposition during the Cretaceous normal-polarity superchron. In the more localized Dangchang basin (~1000 $km^2$), Aptian-Albian palynomorphs and exclusively normal-polarity magnetizations indicate relatively rapid (<20 Myr) deposition of an ~2-km-thick coarse-grained succession during mid Cretaceous time. In the Zhangxian basin (~8000 $km^2$), ~2 km of variable fine- and coarse-grained sediment was deposited during early to mid-Tertiary time, based on Paleocene to Oligocene palynomorphs.

The variations in age, sediment-accumulation rate, facies, provenance, and areal extent of these three basins testify to different mechanisms of basin development across the region during Mesozoic and Cenozoic time. This evidence suggests a spatially and temporally complex history of deformation in northeastern Tibet prior to and during the India-Asia collision. Further constraints on this deformation will be provided by paleomagnetically determined tectonic rotations (see Dupont-Nivet et al., this volume) and additional structural and thermochronological aspects of the project.

## T51B-1150 0830h POSTER

### Geology of the Northeastern Nyainqentanglha Range, Central Tibet

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The Nyainqentanglha range (NQTL) is an uplifted block within the Lhasa terrain of Tibet, created by faults of the late Miocene-Recent Yangbajian Graben to the southeast, and bounded by the Namco depression to the northwest. A geological map (scale: 1:100,000) of the northeastern part of the NQTL and stratigraphic and structural sections have been completed. The older rocks in this area are represented by strongly foliated low-grade metamorphic rock, with a general east-west trend and south dip to foliation. These rocks are unconformably overlain by a first group of red clastics, including coarse conglomerate and sandstone with a general east-west, steeply north-dipping bedding; whose conglomerates contains >90% limestone clasts and small amounts of quartzite clasts with very poor roundness. The second group of red sandstones and conglomerates which outcrops to the northeast contains pebbles from almost all the above mentioned rock types and has low-west trending and south dipping bedding.

Three structural deformation stages can be recognized: (1) Strike-slip ductile shear (sinistral sense) with shortening component, which is developed within the metamorphic rocks, and cut by the above- mentioned unconformity; its timing should be prior to Cretaceous-Paleocene (the presumed age of the red beds). (2) Reverse faulting, along which the metamorphic rocks are thrust over the second type of red clastics, and which appears to cut the unconformity; its timing is likely Tertiary in age (probably Eocene-mid Miocene interval), so this faulting is related to the Eurasia-India collision. (3) Sinistral strike-slip brittle faulting with normal faulting component along the south front of the range, which cuts both of the above-mentioned faults. This faulting has been shown by Armijo et al to be Quaternary in age (Pliocene or slightly earlier to present); this fault forms only a short and atypical segment of the Yadong - Gulu rift system, which accommodates some approximately E- W extension in the overall active India-Asia collision.

## T51B-1151 0830h POSTER

### Early Tertiary Sedimentation and Crustal Deformation Recorded in the Gonje Basin, Eastern Tibet

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Carpathians (Vrancea): **V Mocanu**, A van der Hoeven, W Spakman, G Schmitt, B C Ambrosius

0830 h **T51A-1129** *POSTER* Proterozoic Blueschist-Bearing Melange in the Anti-Atlas Mountains, Morocco: Implications for Pan-African Subduction: **K P Hefferan**, J A Karson, H Admou, R Hilal, A Saquaque, T Juteau, M Bohn

0830 h **T51A-1130** *POSTER* Key Role of the Anaximander Mountains in the Neotectonic Evolution of the Eastern Mediterranean: J H ten Veen, **T A Zitter**, J M Woodside

0830 h **T51A-1131** *POSTER* Thermal Regime and Rheological Properties of the Ossa-Morena Zone and South Portuguese Zone, Iberian Massif, Southern Portugal: **C L Ellsworth**

0830 h **T51A-1132** *POSTER* An Integrated Study of the Holy Cross Mountains region of the Eastern European TESZ in Poland: **M G Averill**, T Bond, P Sroda, G R Keller, K Miller

0830 h **T51A-1133** *POSTER* Wilson Cycles and Strong Orogenic Belts: The Influence of the Paleozoic Ouachita Orogen on Mesozoic Opening of the Gulf of Mexico: **D L Harry**, A D Huerta

0830 h **T51A-1134** *POSTER* Developing a Geothermal Indicator Index From Crustal Geophysical Data for the Western Great Basin: **W A Thelen**, S B Smith, J N Louie, A Concha-Dimas

0830 h **T51A-1135** *POSTER* Numerical modeling of creep in high-contrast Maxwell solids: **R C Bailey**

0830 h **T51A-1136** *POSTER* Active Late Cenozoic Flexures in the Precordillera in Northern Chile: Correlations With the Shallow Seismic Activity, and Implications for the Uplift of the Altiplano: M Farias, R Charrier, **D Comte**, J Martinod, L Pinto, G Herail

0830 h **T51A-1137** *POSTER* Pressure-Temperature-Time Relationships of Allochthons to Basement, Western Gneiss Region, Norway: **E O Walsh**, B R Hacker

0830 h **T51A-1138** *POSTER* The Ultrahigh-Pressure Rocks of Western Norway are Allochthonous: **D Young**, B Hacker, T Andersen

0830 h **T51A-1139** *POSTER* Sensitivity Analysis of a Gravity Inversion Model in Frenchman Flat Basin, Nevada: **G Phelps**

0830 h **T51A-1140** *POSTER* Rates and Causes of Lateral Migration of Basin-floor Submarine Fans and Role of Mass Transport Complexes, Mid Eocene, Spanish Pyrenees: **K T Pickering**, J Corregidor

## T51B MCC: Hall C Friday 0830h
## Tectonics and Structure of Tibet and China Posters

***Presiding:*** **A J Martin**, University of Arizona; **B K Horton**, University of California, Los Angeles

0830 h **T51B-1141** *POSTER* Upholding or fatally altering the boundary conditions for channel flow of the Southern Tibet middle crust: **M EDWARDS**, W Kidd

0830 h **T51B-1142** *POSTER* Differentiating Between Models of MCT Evolution in the Annapurna Range, Central Nepal Himalaya: **A J Martin**, P G DeCelles, P Patchett, C Isachsen, G E Gehrels

0830 h **T51B-1143** *POSTER* Geologic Evolution of the Gyala Peri Massif, Southeastern Tibet: **W Kidd**, P Zeitler, A Meltzer, C Lim, C Chamberlain, L Zheng, Q Geng, Z Tang

0830 h **T51B-1144** *POSTER* Structural Constraints on the Evolution of the Nyainqentanglha Massif, Southeastern Tibet: **J Kapp**, M Harrison, M Grove, P Kapp, L Ding, O Lovera

0830 h **T51B-1145** *POSTER* Ophiolitic Melanges in the Yarlung-Tsangpo "Big Bend" Canyon, SE Tibet: Q Geng, **L Zheng**, G Pan, C Ou, Z Sun, H Dong, X Wang, Y Liu, S Li

0830 h **T51B-1146** *POSTER* The Crustal Structure of Central Tibet Based on Local Earthquake Records and a Reinterpretation of Seismic Data Along the INDEPTH III Profile: R Meissner, **F Tilmann**, S Haines, J Mechie

0830 h **T51B-1147** *POSTER* Timing and Rates of Quaternary normal2 Faulting in Central Tibet: **P M Blisniuk**, W D Sharp

0830 h **T51B-1148** *POSTER* Cretaceous to Tertiary Vertical-Axis Tectonic Rotations of Northeastern Tibet From Preliminary Paleomagnetic Results: **G Dupont-Nivet**, B K Horton, R F Butler, J Wang, J Zhou, H Zhang

0830 h **T51B-1149** *POSTER* Improved Age Constraints for Mesozoic and Cenozoic Basin Development in Northeastern Tibet Based on Magnetostratigraphy and Palynology: **B K Horton**, G Dupont-Nivet, J Zhou, G L Waanders, R F Butler, J Wang, H Zhang

0830 h **T51B-1150** *POSTER* Geology of the Northeastern Nyainqentanglha Range, Central Tibet: **Y Li**, W Kidd, K D Nelson, H Xia, M Edwards, L Ratschbacher, Z Jiang, W Jiang, Z Wu

0830 h **T51B-1151** *POSTER* Early Tertiary Sedimentation and Crustal Deformation Recorded in the Gonje Basin, Eastern Tibet: **C Studnicki-Gizbert**, B Burchfiel, Z Li

0830 h **T51B-1152** *POSTER* GPS Monitoring of Crustal Deformation in Eastern Tibetan Plateau: **Y Liu**, Z Chen, W Tang, J Zhao, Q Zhang, X Zhang, B C Burchfiel, R W King, L H Royden

0830 h **T51B-1153** *POSTER* Active Deformation in Central Tibet: Constraints from InSAR and Geologic Observations: **M Taylor**, G Peltzer, A Yin, F J Ryerson, R Finkel, D Lin

0830 h **T51B-1154** *POSTER* How Does the Kunlun Fault End?: **E Kirby**

0830 h **T51B-1155** *POSTER* Tectonics in East Asia : Contiunous or block-wise?: **M Iwakuni**, T Kato, S Miyazaki, W Sun

0830 h **T51B-1156** *POSTER* Kinematics and structures of the ultra-high-pressure Sulu terrane, eastern China: **L E Webb**, M L Leech, T Yang, Z Xu

0830 h **T51B-1157** *POSTER* Extensional collapse of a Mesozoic intraplate fold-and-thrust belt, Daqing Shan, Inner Mongolia, China: **B J Darby**, G A Davis, Y Zheng

0830 h **T51B-1158** *POSTER* Tertiary Shortening along the Eastern Portion of the North Qaidam Thrust System: **A C Robinson**, A Yin, C A Menold, X Chen, W X Feng

0830 h **T51B-1159** *POSTER* Tectonic Evolution of the North Qaidam UHP Complex, Western China: **C A Menold**, C E Manning, Y An, R C Alex, X Chen

0830 h **T51B-1160** *POSTER* The ICDP Information Network and the Chinese Continental Scientific Drilling CCSD: **R Conze**, D Su

0830 h **T51B-1161** *POSTER* Paleozoic and Cenozoic Tectonic Evolution of the Russian and Chinese Altai Mountains: A Preliminary Report: **S M Briggs**, A Yin, C E Manning, A G Vladimirov

0830 h **T51B-1162** *POSTER* The 1971 Artyk Earthquake: Is the Locus of Motion Changing in Northeast Russia?: **K Fujita**, M S McLean, K G Mackey, B M Kozmin

## T51C MCC: Hall C Friday 0830h
## Neotectonics Posters

***Presiding:*** **D D Bowman**, California State University, Fullerton; **C P Huebscher**, Institute of Geophysics University of Hamburg

0830 h **T51C-1163** *POSTER* Evidence for Quaternary Faulting Along the Apricena Tectonic Lineament (Gargano Area, Italy): **F Cinti**, F Doumaz, J J Young, M Moro, S Salvi, L Colini, S Pierdominici

0830 h **T51C-1164** *POSTER* Raised Marine Terraces in the Sibari Plain (Calabria, Southern Italy): the Geological Record of Fast Regional Uplift and Local Fault Deformation: **L Cucci**

# 2002
# Fall Meeting Program and Abstracts

AGU
FALL MEETING
SAN FRANCISCO
6-10 December

This CD-ROM contains the program and abstracts of the 2002 Fall Meeting. The information is stored in both HTML and PDF formats as browsable tables and a searchable database. The CD-ROM is designed to run on Windows and Macintosh platforms.

## Software Requirements

A version 4.* or later WWW browser (Netscape Navigator or MS Internet Explorer) with Java support is required to browse and search the abstracts. It is recommended to use the latest available browser release. To view, print or search the PDF files, the Adobe Acrobat Reader is required. To download, go to:
http://www.adobe.com/products/acrobat/readstep2.html

## Installation Instructions

### WINDOWS 9*/ME/NT/2000/XP

The default page index.htm will be loaded automatically in the browser when the CD is inserted into the CD-ROM drive. No special installation of files on to the hard disk is required.

### MACINTOSH

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1. Select "Run" to run MacStart script when prompted after inserting CD.
2. Choose Stuffit Expander to open Go.hqx (this starts Java console which will say "Waiting for client's request !!!").
3. Click the CD icon on the desktop and open index.htm in the browser.

Note for Macintosh OS X users: Refer to the README.txt file on the CD-ROM.

**Multi-Platform CD-ROM (ISO 9660 + Joliet Extensions)**
Windows 95/98/ME/NT/2000/XP
Macintosh 8.* or later

### PDF-Search

As an alternative, a searchable index of the collection of session PDF files is included. See README.txt on the CD-ROM for more details.

### Abstracts should be cited as

Eos Trans. AGU, 83 (47), Fall Meet. Suppl., Abstract XXXXX-XX, 2002