



Geological Society of Nevada

SOUTHERN NEVADA CHAPTER

Newsletter

December, 2000

Organic geochemistry and linked tectonics/sedimentation of basins in Northwest China

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DATE: Thursday, January 25, 2001

SPEAKER: Andrew Hanson

LOCATION: Room 102 Lilly Fong Geoscience Building

TIME: 5:30 p.m. Social hour
6:30 p.m. Presentation

Organic Geochemistry and Linked Tectonics and Sedimentation of Basins in Northwest China

Andrew Hanson- UNLV Assistant Professor of Geology

Abstract (GSN- Las Vegas meeting on Jan 25, 2001)

Stratigraphic sections adjacent to the northern margin of the Qaidam basin and along the southern margin of the Tarim basin in NW China record the Cenozoic tectonic history of the surrounding structural elements. Field-based studies were combined with sandstone petrography, heavy mineral studies, apatite fission-track analyses, and stable isotope analyses to examine provenance, sediment dispersal patterns, uplift of sediment source regions, rates of sedimentation, paleoclimate, and depositional environment histories preserved within these sections.

In the Qaidam basin during the Oligocene, sediment dispersal patterns adjacent to the Altun Shan were directed either away from, or transverse to the Altun Shan. In Miocene and younger strata in NW Qaidam paleocurrents indicate flow directions away from the Qimantagh. In north-central Qaidam Miocene paleocurrents are directed away from the Altun Shan. Cenozoic strata in NE Qaidam record flow away from adjacent present day topographic highs (i.e., the Qilian Shan). In the Tarim basin, Oligocene paleocurrents at the Ruoqiang coal mine are longitudinal to the modern Altun Shan range front. However, paleocurrents within younger strata are all directed away from the range front. At Kashitashi, Eocene strata preserve paleocurrent indicators that are directed longitudinal to the Kunlun Shan front along the southwest margin of Tarim. At Pianaman, Oligocene paleocurrents are scattered but have a mean vector indicating dominant directions toward the southeast, similar to the Eocene Kashitashi measurements. In the Pliocene, the paleocurrent directions reverse and are oriented to the north.

Provenance data tie sediments preserved within each section to adjacent structural/topographic elements. For example, volcanic clasts in the Lenghu section are derived from Ordovician volcanic rocks exposed in the adjacent southern portion of the Qilian Shan. Phenocrystic K-spar granitic clasts in the Oboliang section can be linked to plutons along the northern margin of Qaidam (south of the Altun Tagh fault) upon which the section depositionally lies. Sandstone petrography results from northeast and north-central Qaidam sections indicate a more feldspar- and lithic-rich composition dominated by plagioclase and metamorphic grains than associated Mesozoic sandstones, which are more quartz-rich. Calculated zircon-tourmaline-rutile (ZTR) ratios from heavy mineral analyses, and sandstone petrography both indicate an increasingly immature suite of sandstones in Miocene and younger sediments than in Oligocene and older samples. Apatite fission-track results from the base of the Ruoqiang section yield a cooling age of 17 ± 1 Ma. These

features are interpreted as being indicative of unroofing of the surrounding structural elements from at least the Miocene to the present.

Organic facies that occur within Oligocene-Pliocene strata in Qaidam basin are not present in southern Tarim. Oligocene petroleum source rocks in Qaidam are lacking in terrestrial biomarkers, and samples from Tertiary strata of both Tarim and Qaidam on which palynological analyses have been completed are generally barren.

Several lines of evidence indicate that Tarim and Qaidam were separate basins from at least the Oligocene. Whereas Qaidam contains numerous lacustrine sections and a documented petroleum source rock in the Tertiary, southern Tarim lacks any organic-rich facies in the Tertiary. Sandstone data indicate that Tarim Tertiary sandstones are significantly more quartz-rich than are Qaidam sandstones. Previous work has shown that the depocenter in Qaidam migrated southward away from the Altun Shan throughout the Tertiary. Finally, previously published seismic data from Qaidam show growth structures in most of the Oligocene-Recent part of the sedimentary section, indicative of the onset and continuation of deformation in the Tertiary. These data suggest that northeast-vergent thrusting along the Qimantagh; southwest-vergent thrusting along the southern Qilian Shan; northeast-vergent thrusting along the southwest Tarim Kunlun Shan; and an elevated Altun Shan, both north and south of the Altun Tagh fault (potentially related to Altun Tagh fault displacement), may have persisted since at least the Oligocene.

Our organic geochemical study of oils from the northern Qaidam basin defines a family of genetically-related oils which contain biomarkers indicative of source rocks deposited in Tertiary hypersaline, anoxic lacustrine settings. Although Cenozoic outcrop samples from northern Qaidam are too organic lean to be of source quality, dark laminated upper Oligocene mudstones containing gypsum crystals and pyrite from the Shi 28 well yield TOC and Rock-Eval data indicative of fair to good source rocks. Organic matter is derived from algae and bacteria with an apparent lack of terrestrial material. Biomarker data provide a good correlation between the produced oils and the upper Oligocene Shi 28 core samples. Hydrocarbons derived from these source rocks are contained in upper Oligocene, Miocene, and Pliocene reservoirs. Although eight of the oil samples are from the NW corner of the basin, one sample in this genetic family of hypersaline oils comes from NE Qaidam, an area previously believed to only produce oils derived from Jurassic freshwater lacustrine source rocks. This sample thus indicates the presence of an unidentified and undocumented source rock in the NE part of the basin. Hypersaline oils and the associated source rocks have low biomarker maturity parameters. Thermal modeling indicates that hydrocarbon generation probably occurred in northwestern Qaidam within the last 3 million years.

Andrew Hanson

Andrew Hanson received a BS in Nursing from Montana State University in 1979. After working as an Operating Room nurse for several years, he returned to school at San Diego State University and completed undergraduate classes in geology and continued on to receive an MS in Geoscience in 1993. He continued his education at Stanford University and received a Ph.D. in Geological and Environmental Sciences in 1999. Internships with Mobil Producing in Bakersfield, CA and with Texaco in Houston, TX led to full-time employment after graduation with Texaco's International Exploration Division where he was a geoscientist with the Nigeria Exploration team. Andrew joined the faculty at UNLV in August of 2000. He is a member of AAPG, GSA, SEPM, GSN, the Houston Organic Geochemical Society and the Geologic Modeling Society of Houston.

Announcements

Look! Its a *NEW* GSN web site!

<http://www.gsnv.org>

If you know of anyone that would like to become a member of if you need to renew your membership in the Geological Society of Nevada, a membership application is attached.

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Do you know someone who has moved and not told us? A few newsletters are returned because of incorrect addresses following each mailing. If you are aware of someone who hasn't received a newsletter, please have them call or email Paul Bowen at (702)247-7765 or p_jbowen@ix.netcom.com. You may also contact Donna Bloom at GSN headquarters to update this information. Thanks!

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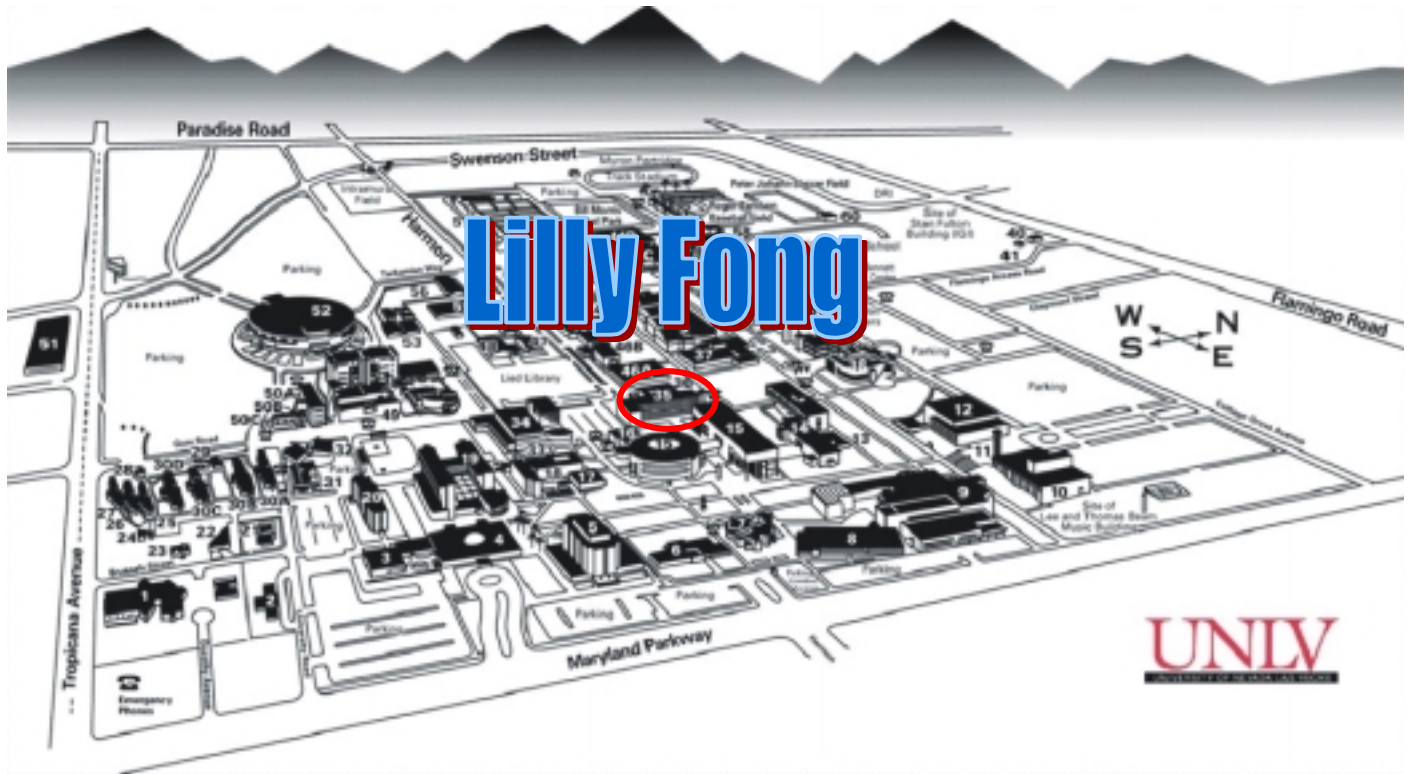
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PROPOSED DATES FOR TALKS

- 30 November 2000 **Jim O'Donnell**
 25 January 2001 **Dr. Andrew Hanson**
 22 February 2001
 22 March 2001
 26 April 2001 **Student Presentations**
 24 May 2001

As you can see we need to fill in the gaps. Also if anyone would like to volunteer to give a talk or host a discussion in December we would be open for suggestions. Some of us aren't going anywhere.



Publication and mailing of this newsletter has been contributed by The UNLV Department of Geoscience.

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