Wednesday, March 26, 2003

Petroleum Club, 800 Bell (downtown)
Social 11:15 a.m., Lunch 11:45 a.m.

Cost: $28 Preregistered members; $33 Nonmembers & Walk-ups (Note Price Increase)

Make your reservations now by calling 713-463-9476 or by e-mail to Joan@hgs.org (include your name, meeting you are attending, phone number, and membership ID#).

HGS/GSH Joint Luncheon Meeting

by ***Dale Bird***
Bird Geophysical, Houston, TX

Gulf of Mexico Evolution and Structure

Kinematic reconstructions of tectonic plates can be facilitated by a prior knowledge of basin shapes, relative ages, and extents of key horizons and structures, and geophysical constraints such as gravity, magnetic, and seismic data. Still a "global view" is necessary to ensure theorized kinematic solutions are compatible with neighboring regions.

Over 100 seismic refraction profiles and over 70 basement or near-basement well penetrations were used as control and calibration for interpreting open-file magnetic anomaly profiles over the Gulf of Mexico basin and northern Gulf coastal plain. The shape of the Gulf of Mexico basin was interpreted by estimating basement depths from these profiles. The derived basement surface was imported into 12 mega-regional gravity and magnetic modeled cross sections. These formed a skeletal network that integrated gravity, seismic, well, and magnetic data into regional slices through the basin that, in turn, were modified to support the basement interpretation.

A NW–SE trending free air gravity anomaly high that dominates the Keathley Canyon protraction area may be evidence of a Late Jurassic mantle plume

In some respects, results from the basement analysis reveal no surprises. The central part of the basin deepens to the west from about 9 to over 15 km, and the basin probably formed by counter-clockwise rotation of the Yucatan Block over a 20–My period between approximately 160 and 140 Ma. However, two significant results related to basin formation are revealed by the basement interpretation. First, the existence of a NW–SE Bahama fracture zone through southern Florida is not supported. Second, a NW–SE trending free air gravity anomaly high that dominates the Keathley Canyon protraction area may be evidence of a Late Jurassic mantle plume. The conjugate hotspot track to the Keathley Canyon anomaly is related to another prominent free air gravity anomaly, which is concentric with the coast of the Yucatan Peninsula, through the center of the basin.

Hotspot tracks are proposed to exist in the central Gulf of Mexico based on their size, shape, and alignment with hotspot-referenced North American Plate and Yucatan Block motions between 160 and 140 Ma. Size and shape are modeled in cross sections constrained by gravity and seismic refraction data, and rise approximately 3 to 4 km over the surrounding basement.

The hotspot tracks

- can be restored by 20° of relative rotation between the North America Plate and the Yucatan Block about a pole located near 24°N and 81.5°W
- define the southern limit of autochthonous salt in the northern Gulf Salt Basin and the northern limit of autochthonous salt in the Campeche Salt Basin
- require 8 to 10 My to form in the hotspot reference frame and
- define northern, southern, and eastern limits of oceanic crust in the basin.

Therefore, the basin formed by

- 8 to 10 My of continental extension and salt depostion during about 20° of counter-clockwise rotation of the Yucatan Block relative to North America, followed by
- 8 to 10 My of sea floor production during continued counter-clockwise rotation of the Yucatan Block (approximately an additional 20°). ■

Biographical Sketch

Prior to founding Bird Geophysical in 1997, DALE BIRD established and managed an affiliate office in Houston for Aerodat Inc., an international airborne geophysical survey company. During his 19-year career he has also been the Chief Geophysicist for World Geoscience Inc. (Americas), another international airborne geophysical ➢

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survey company, and a geophysicist with Marathon Oil Company, Digicon Inc., and Aero Service Division of Western Atlas International Inc. Dale's experience includes most aspects of exploration including data acquisition, processing, interpretation and marketing. Before this he served in the US Army, 1st Military Intelligence Battalion, as an Image Interpreter specializing in analyses of various imagery formats.

Dale has served the GSH in the past as editor, and as chair of the Potential Fields Group. He is also a member of the SEG (past Chair of the Gravity and Magnetics Committee), AAPG, EAGE, AGU, HGS, and National Eagle Scout Association. Dale earned BS and MS geophysics degrees and is currently a Ph.D. candidate (geophysics) at the University of Houston.