

# STRUCTURE OF HANNA TROUGH AND FACIES OF ELLESMERIAN SEQUENCE, U.S. CHUKCHI SHELF, ALASKA

*Kirk W. Sherwood*

*Minerals Management Service, Centerpoint Financial Center, 3801 Centerpoint Drive, Anchorage, Alaska 99503-5823; Ph 907-334-5337; e-mail kirk.sherwood@mms.gov*

Hanna trough is a rift basin of probable Devonian to Late Jurassic age that trends north beneath the U.S. Chukchi shelf offshore northwestern Alaska. The basin formed a depocenter for the accumulation of over 38,000 feet (11,600 m) of strata of the Ellesmerian sequence and is a westward extension of the petroleum-rich Arctic Alaska basin that underlies the Alaska North Slope. Hanna trough overlies a seismic basement that appears to consist of Devonian and older terranes that were assembled into a crustal unit with a northerly structural grain in pre-Middle or Late Devonian time. A magnetic high may mark a magmatic arc within basement that apparently contributed granitic sedimentary debris found within Mississippian and Pennsylvanian calcareous sandstones beneath Chukchi shelf.

Hanna trough rift structures also developed along northerly lines that mimic the northerly grain of basement. The fundamental structural units of Paleozoic rifting, and the sites of earliest sedimentation, are half-grabens that pervasively floor Hanna trough. The half-grabens are floored by wedge-shaped bodies of strata that are correlated by seismic inference to the Endicott Group (Upper Devonian to Mississippian). Fault-driven subsidence occurred mostly from Devonian (inferred) to Permian time and controlled deposition of over 36,000 feet (11,000 m) of strata of the Lower Ellesmerian sequence. From Late Permian to Late Jurassic time, a "sag" phase of subsidence controlled the deposition of up to 12,000 feet (3,660 m) of strata of the Upper Ellesmerian sequence in Hanna trough.

The oldest rocks penetrated by wells on Chukchi shelf are Upper Mississippian rocks equivalent to the Lisburne Group. The lithofacies and petrology of clastic rocks suggest the existence of highland sediment sources both east and west of Hanna trough for Mississippian through Permian sequences. The western highland (Chukchi platform) was subdued or absent by the time of deposition of the mostly basal rocks of Triassic and younger ages in western Hanna trough. The eastern highland sediment source (Arctic platform) remained active through Late Jurassic time. Within the Upper Ellesmerian sequence (Late Permian to Late Jurassic), facies transitions from the east margin to paleogeographic deeps in Hanna trough mimic the well-documented and familiar facies transitions in time-equivalent strata from north (margin) to south (deep basin) in the Arctic Alaska basin.

Additional Information: Sherwood, K.W., Johnson, P.P., Craig, J.D., Zerwick, S.A., Lothamer, R.T., Thurston, D.K., and Hurlbert, S.B., 2002, Structure and stratigraphy of the Hanna Trough, U.S. Chukchi Shelf: in Miller, E.L., Grantz, A., and Klemperer, S.L. (eds.), *Tectonic Evolution of the Bering Shelf-Chukchi Sea-Arctic Margin and Adjacent Landmasses*: Boulder, Colorado, Geological Society of America Special Paper 360, p. 39-66.

Presented at Joint Conference of Geological Society of America (Cordilleran Section), American Association of Petroleum Geologists (Pacific Section), and Society of Petroleum Engineers (Western Region), "North to Alaska: Geoscience, Technology and Natural Resources," 08-10 May 2006, Anchorage, Alaska.

Reference: Sherwood, K.W., 2006, Structure of Hanna Trough and Facies of Ellesmerian Sequence, U.S. Chukchi Shelf, Alaska (Abstract with 2 Posters): *2006 Joint Meeting of Cordilleran Section, Geological Society of America (GSA), Pacific Section, American Association of Petroleum Geologists (AAPG), and Alaska/Western Section of Society of Petroleum Engineers (SPE), 08-10 May, Anchorage, Alaska*, Geological Society of America Abstracts, Volume 38, No. 5, abstract 37-2, p. 85.

[Poster 1 – Hanna Trough - Structure and Facies Maps for Basin Fill](#)

[Poster 2 – Hanna Trough - Wellbore Stratigraphy and Regional Seismic Lines](#)