Petroleum Exploration on Sukhbaatar Block in Eastern Mongolia*

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Abstract

Mongolia contains several under-explored sedimentary basins. These basins are geologically similar to highly productive basins in China. No basins had been previously identified on the Sukhbaatar Block which covers approximately 22,600 square kilometers in Eastern Mongolia. An interdisciplinary approach was used to evaluate the block. Land-based gravity and magnetic surveys were conducted, processed and used to define the location of the Cretaceous lacustrine rift basins. A remote sensing study included structural, lithologic and alteration mineral interpretation utilizing enhanced multispectral satellite imagery and digital elevation model data. Approximately 450 line kilometers of 2D seismic was conducted, processed and interpreted, further defining the basin location. A hydrocarbon geochemical survey was conducted using the seismic shot hole sediments, results indicate that volatile and liquid hydrocarbon microseeps are evident at the basin margins and at the surface expression of faults. Integrating these studies along with geologic field mapping has resulted in several prospects/leads to be drilled.

Selected References


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AAPG Annual Conference
May 31- June 3, 2015
Outline

- Geologic Setting
- Exploration Program
  - Phase 1
    - Gravity and Magnetics
    - Remote sensing
    - Field Mapping
  - Phase 2
    - 2D Seismic
    - Geochemistry
- Conclusions
Petroleum Blocks in Mongolia

Sukhbaatar Block
22,600 km²

Producing areas

Recent Activity
Structural Setting

Structural complex with 44 terranes & 3 mega-shear zones identified

Yonghong, 2004

Accretionary & amalgamation complex

Badarch, 2002
Cretaceous Lacustrine Rift Basins

Yonghong, 2004
Major tectonic phases in E Mongolia

Complex history of extension and inversion of pre-existing faulting

Johnson, 2012
Exploration Program Phase 1

- Location of the rift basins unknown
  - Surface geologic map, based on Russian mapping from 1950-60’s reconnaissance

- Gravity and magnetic data acquired and reprocessed from land based survey to help define sub-basin/basin areas

- Remote sensing study- integrated gravity & magnetic data, multispectral satellite imagery, DEM, structural interpretation & alteration mineral modelling
## Stratigraphy and Surface Geology

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![Geological Map](image-url)

![Field Photos](image-url)
Gravity and Magnetic survey – Jan 2013

Gravity 6378 stations
Magnetic – 82 traverse lines spaced 2000 m apart
Identified Basins on Landsat Imagery

Landsat enhanced true color 2013
Gravity and Magnetic data

- Gravity (1VD) on DEM
- Magnetic data (RTP) on DEM
Remote Sensing Integration

Alteration Mineral Modeling associated with hydrocarbon fluids

Why is it altered?

“Lisbon Valley, UT Model”

Why is it altered?
Phase 2 Exploration Program

- 2D Seismic approximately 450 Km (dynamite)
- Shot hole sampling for geochemical analysis (639 shot hole samples analyzed 84)
- Interpretation of seismic, geochemical and remote sensing
UU and TV Basins

Tuvshinshiree Sub basin  Uulbayan Sub basin

110 Km
Types of Traps

- **Structural**
  - Roll over into faults
  - Horst blocks
  - Tilted fault blocks

- **Stratigraphic**
  - Unconformities
  - Pinchouts
  - Thickening and thinning

Diagrams showing examples of structural and stratigraphic traps.
Geochemistry Results

- Oil & wet gas microseeps are evident over the edges of the basins
- Most likely a high gravity crude
- C2+ (Volatile HC) and C5+ (Liquid HC) spatially associated with faults
Drilling Targets

- Structure Tsagaantsav UU sub basin

- Source Rocks

- Reservoirs
  - Pyroclastic
  - Turbidites
  - Deltas
  - Fluvial
  - Alluvial Fans

- Depths
  - 2000-3000 meters

- Seals
  - Shales
  - Faults
Conclusions

- Frontier exploration characterization using multi-disciplines (gravity, mag, satellite imagery, geochem and seismic)
- Numerous trap types identified
  - Structural
  - Stratigraphic
  - Combined structural/stratigraphic
- Potential for stacked reservoirs
- Petroleum system identified
- Analogous setting to existing Mongolian production
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