



Deformed Belt Assessment Unit 40470201



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-  North Carpathian Basin Geologic Province 4047

USGS PROVINCE: North Carpathian Basin (4047)

GEOLOGIST: M.J. Pawlewicz

TOTAL PETROLEUM SYSTEM: Mesozoic/Paleogene Composite (404702)

ASSESSMENT UNIT: Deformed Belt (40470201)

DESCRIPTION: This assessment unit is defined by the Oligocene Menilite Shale and Cretaceous and Jurassic units overthrust and in duplexes in the foreland portion of the North Carpathian province. The Menilite Shale is strictly a source rock while the Cretaceous and Jurassic contain both source and reservoir.

SOURCE ROCKS: The Oligocene Menilite Shale is the principal source for oil in the entire Carpathian region. The Cretaceous Spas Formation shows potential; in the Skole nappe in Ukraine, the peak of oil generation is at 4.2 km, but still in the mature stage in Poland at 6.9 km. Jurassic carbonates are known to be a limited source. Mixing of oils in the various traps obscures the extent of contribution from each.

MATURATION: Maturation ranges from sub oil window in outcrop to beyond the oil window thought to extend from 4 to 6 km in depth. In Ukraine, the Menilite is as deep as or deeper than 10 km.

MIGRATION: Migration is probably less than 3 km, for the most part updip and along faults. In parts of Poland north of the foreland-foredeep boundary, suspected very long range migration (50 to 100 km) during early generation of oil. Oil in the foreland is thought to have migrated two times, once prior to the final emplacement of the flysch nappes and associated cordilleras, which today prevent or limit migration south to north. Migration probably commenced in Miocene time and is still on going.

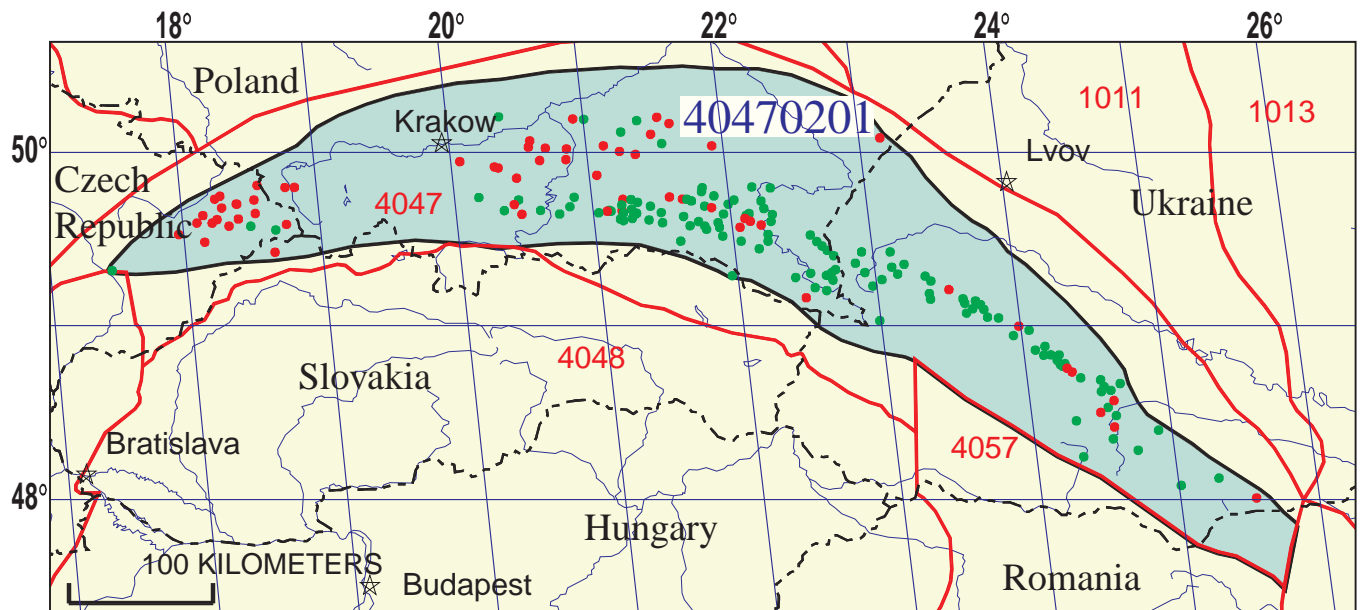
RESERVOIR ROCKS: Sandstone and siltstone throughout the largest part of the region; Jurassic age carbonates throughout much of Ukraine and parts of Poland.

TRAPS AND SEALS: Traps are primarily fault-bounded blocks; in addition, there are often repeated sections of overthrust flysch units either in imbricated sections or in duplexes. Stratigraphic traps are less common. Shales in the flysch units are common seals in overthrust units. Clays at the bottom of the molasse seal much of the sub-thrust hydrocarbons in pre-Miocene sediments.

REFERENCES:

- Bessereau, G., and others, 1996, Structure and hydrocarbon habitat of the Polish Carpathians, *in* Ziegler, P.A., and Horvath, F., eds., Peri-Tethys Memoir 2—Structure and prospects of alpine basins and forelands: Mem. Museum of Natural History, v. 170, p. 343-373.
- Koltun, and others, 1998, Petroleum generation in the Ukrainian external Carpathians and the adjacent foreland: *Journal of Petroleum Geology*, v. 21, p. 265-288.

- Koltun, Yuri, et al., 1995, Hydrocarbon potential of the Menilite and Spas beds in the Polish and Ukrainian parts of the flysch Carpathians, report from conference and exhibition-Modern exploration and improved oil and gas recovery methods, Crakow, Poland, September 12-15: p. 147-150.
- Koster, J., and others, 1998, Source rock habitat and hydrocarbon potential of Oligocene Menilite Formation (Flysch Carpathians, Southeast Poland)—an organic geochemical and isotope Approach: *Organic Geochemistry*, v. 29, no. 1-3, p. 543-558.



Deformed Belt Assessment Unit - 40470201

EXPLANATION

- Hydrography
- Shoreline
- 4047 Geologic province code and boundary
- - - Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 40470201 — Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

**SEVENTH APPROXIMATION
NEW MILLENNIUM WORLD PETROLEUM ASSESSMENT
DATA FORM FOR CONVENTIONAL ASSESSMENT UNITS**

Date:..... 9/9/99
 Assessment Geologist:..... M.J. Pawlewicz
 Region:..... Europe Number: 4
 Province:..... North Carpathian Basin Number: 4047
 Priority or Boutique..... Priority
 Total Petroleum System:..... Mesozoic/Paleogene Composite Number: 404702
 Assessment Unit:..... Deformed Belt Number: 40470201
 * Notes from Assessor Lower 48-all growth function.

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (\geq 20,000 cfg/bo overall):... Oil

What is the minimum field size?..... 1 mmmboe grown (\geq 1mmboe)
 (the smallest field that has potential to be added to reserves in the next 30 years)

Number of discovered fields exceeding minimum size:..... Oil: 30 Gas: 28
 Established (>13 fields) X Frontier (1-13 fields) _____ Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
 1st 3rd 8 2nd 3rd 4 3rd 3rd 5
 Median size (grown) of discovered gas fields (bcfg):
 1st 3rd 129 2nd 3rd 21 3rd 3rd 16

Assessment-Unit Probabilities:

| <u>Attribute</u> | <u>Probability of occurrence (0-1.0)</u> |
|---|--|
| 1. CHARGE: Adequate petroleum charge for an undiscovered field \geq minimum size..... | <u>1.0</u> |
| 2. ROCKS: Adequate reservoirs, traps, and seals for an undiscovered field \geq minimum size..... | <u>1.0</u> |
| 3. TIMING OF GEOLOGIC EVENTS: Favorable timing for an undiscovered field \geq minimum size | <u>1.0</u> |

Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):..... 1.0

4. **ACCESSIBILITY:** Adequate location to allow exploration for an undiscovered field
 \geq minimum size..... 1.0

UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are \geq minimum size?:
 (uncertainty of fixed but unknown values)

Oil fields:.....min. no. (>0) 10 median no. 60 max no. 150
 Gas fields:.....min. no. (>0) 6 median no. 50 max no. 125

Size of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:
 (variations in the sizes of undiscovered fields)

Oil in oil fields (mmbo).....min. size 1 median size 3 max. size 100
 Gas in gas fields (bcfg):.....min. size 6 median size 15 max. size 400

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

| <u>Oil Fields:</u> | minimum | median | maximum |
|-----------------------------------|---------|--------|---------|
| Gas/oil ratio (cfg/bo)..... | 1500 | 3000 | 4500 |
| NGL/gas ratio (bnl/mmcf)..... | 30 | 60 | 90 |
| <u>Gas fields:</u> | minimum | median | maximum |
| Liquids/gas ratio (bnl/mmcf)..... | 5 | 10 | 15 |
| Oil/gas ratio (bo/mmcf)..... | | | |

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS

(variations in the properties of undiscovered fields)

| <u>Oil Fields:</u> | minimum | median | maximum |
|---|---------|--------|---------|
| API gravity (degrees)..... | 14 | 36 | 55 |
| Sulfur content of oil (%)..... | 0.1 | 0.5 | 2.3 |
| Drilling Depth (m) | 300 | 1500 | 6000 |
| Depth (m) of water (if applicable)..... | | | |
| <u>Gas Fields:</u> | minimum | median | maximum |
| Inert gas content (%)..... | | | |
| CO ₂ content (%)..... | | | |
| Hydrogen-sulfide content (%)..... | | | |
| Drilling Depth (m)..... | 300 | 1800 | 7000 |
| Depth (m) of water (if applicable)..... | | | |

**ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT
 TO COUNTRIES OR OTHER LAND PARCELS** (uncertainty of fixed but unknown values)

1. Poland represents 51 areal % of the total assessment unit

| <u>Oil in Oil Fields:</u> | minimum | median | maximum |
|---|---------|-----------|---------|
| Richness factor (unitless multiplier):..... | _____ | _____ | _____ |
| Volume % in parcel (areal % x richness factor):... | _____ | <u>53</u> | _____ |
| Portion of volume % that is offshore (0-100%):..... | _____ | <u>0</u> | _____ |

| <u>Gas in Gas Fields:</u> | minimum | median | maximum |
|---|---------|-----------|---------|
| Richness factor (unitless multiplier):..... | _____ | _____ | _____ |
| Volume % in parcel (areal % x richness factor):... | _____ | <u>70</u> | _____ |
| Portion of volume % that is offshore (0-100%):..... | _____ | <u>0</u> | _____ |

2. Ukraine represents 44 areal % of the total assessment unit

| <u>Oil in Oil Fields:</u> | minimum | median | maximum |
|---|---------|-----------|---------|
| Richness factor (unitless multiplier):..... | _____ | _____ | _____ |
| Volume % in parcel (areal % x richness factor):... | _____ | <u>45</u> | _____ |
| Portion of volume % that is offshore (0-100%):..... | _____ | <u>0</u> | _____ |

| <u>Gas in Gas Fields:</u> | minimum | median | maximum |
|---|---------|-----------|---------|
| Richness factor (unitless multiplier):..... | _____ | _____ | _____ |
| Volume % in parcel (areal % x richness factor):... | _____ | <u>10</u> | _____ |
| Portion of volume % that is offshore (0-100%):..... | _____ | <u>0</u> | _____ |

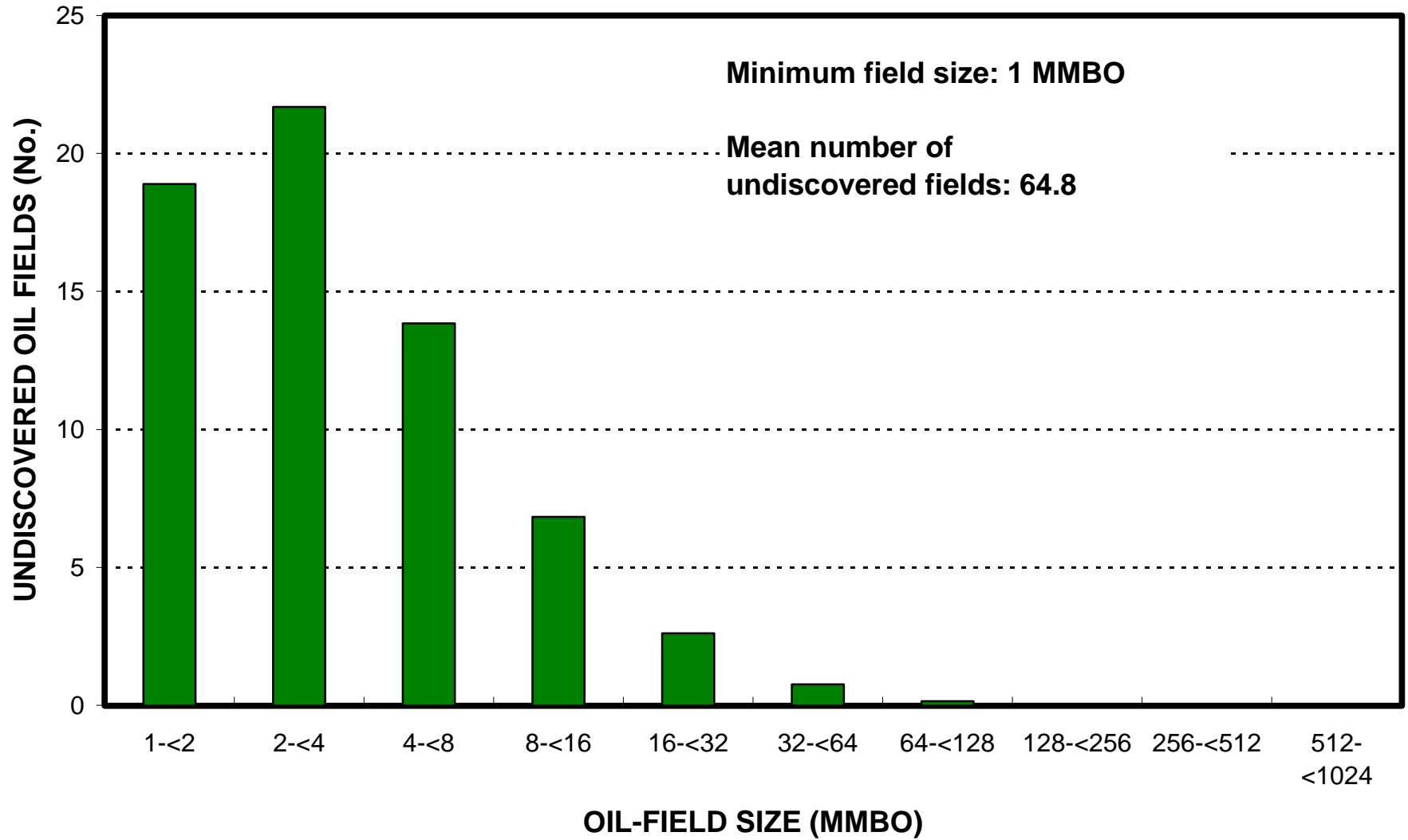
3. Czech Republic represents 5 areal % of the total assessment unit

| <u>Oil in Oil Fields:</u> | minimum | median | maximum |
|---|---------|----------|---------|
| Richness factor (unitless multiplier):..... | _____ | _____ | _____ |
| Volume % in parcel (areal % x richness factor):... | _____ | <u>2</u> | _____ |
| Portion of volume % that is offshore (0-100%):..... | _____ | <u>0</u> | _____ |

| <u>Gas in Gas Fields:</u> | minimum | median | maximum |
|---|---------|-----------|---------|
| Richness factor (unitless multiplier):..... | _____ | _____ | _____ |
| Volume % in parcel (areal % x richness factor):... | _____ | <u>20</u> | _____ |
| Portion of volume % that is offshore (0-100%):..... | _____ | <u>0</u> | _____ |

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Undiscovered Field-Size Distribution



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Undiscovered Field-Size Distribution

