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Zala-Drava-Sava Basins
Assessment Unit 40480201

Zala-Drava-Sava Basins Assessment Unit 40480201

Pannonian Basin Geologic Province 4048

Geologic Summary

Detailed map of this assessment unit

Exploration/Discovery-History Data

- Plots of Known Field Sizes
- Plots of Grown Resources
- Tables

Assessment Input Data

Assessment Results

- Assessment Unit Summary
- Detailed Assessment Results
- Undiscovered Field-Size Distributions

USGS PROVINCE: Pannonian Basin (4048) **GEOLOGIST:** G.L. Dolton

TOTAL PETROLEUM SYSTEM: Zala-Drava-Sava Mesozoic/Neogene (404802)

ASSESSMENT UNIT: Zala-Drava-Sava Basins (40480201)

DESCRIPTION: This assessment unit deals with traps and accumulations in the Cenozoic basin fill and in the underlying basement which were charged variously by Neogene and Mesozoic source rocks. Significant vertical and lateral migration characterize this unit, particularly with reference to gas, and it contains both single and hybrid petroleum systems, depending upon the area. Structural, stratigraphic and combination traps in the Neogene, include growth faults, compaction features over basement highs and pinchouts in fluvial, shallow water, and turbidite sandstones and conglomerates, and unconformity traps, particularly at the regional unconformity between middle Miocene synrift and Pannonian postrift rocks.

SOURCE ROCKS: Marine Miocene Pre-Pannonian and lower Pannonian lacustrine organic-rich rocks, and, locally Upper Triassic Kössen Marl in the Alpine basement complex are considered the principal sources of oil and natural gas. Distribution of Mesozoic source rocks is poorly known and is related to the paleotectonic affinities of the basement nappes. In the Transdanubian Central Range of western Hungary, the Kössen Marl Formation has excellent source rock potential but is limited to the Pelso crustal element and has not been recognized over much of the Drava trough and eastern Zala basin.

MATURATION: Source rocks reached maturity in late Miocene with generation and expulsion from both Triassic and Miocene organic-rich rocks. In all of the basins, the Neogene is in an active oil and gas generative phase. In axial areas, Mesozoic rocks, where present, are sufficiently buried to be in a gas generative phase. Some workers document a break in the vitrinite profile in the region, indicating a pre-Neogene thermal event, which affected the Mesozoic sequence, followed by burial and heating in the Neogene. The entrapped gas locally contains substantial CO_2 as a result of thermal decomposition of carbonates in basement nappes.

MIGRATION: Timing of migration is favorable with reference to trap formation accompanied by extensive vertical migration.

RESERVOIR ROCKS: Neogene sandstone reservoirs of the basin fill and Mesozoic and Paleozoic reservoirs of basement nappes constitute the principal reservoirs. Included are Miocene marls and occasional biohermal buildups (patch reefs). The most important Neogene reservoirs are within the Miocene Badenian, Sarmatian and Lower Pannonian intervals.

Reservoirs of the basement complex are largely dolomites, limestones and sandstones. They include Cretaceous rudisted limestone and Upper Triassic dolomites (Hauptdolomite) and marls in the Zala basin and, in the Drava basin, Lower Jurassic and Middle Triassic dolomite, Lower Triassic quartzites, and Devonian schists. In all instances, fracturing is important in reservoir development.

TRAPS AND SEALS: In the basin fill, traps are structural, stratigraphic and combination, including a variety of tectonic, compactional and syndepositional types and a suite of stratigraphic types. Many are associated basement highs and with positive structures along strike-slip faults. Subtle traps are associated with stratigraphic pinchouts and syndepositional features and unconformities, particularly with those associated with the regional unconformity between synrift and postdrift rocks, and in turbidite sequences. Traps in the basement complex include Mesozoic and Paleozoic reservoirs in paleotopographic highs and internal structural traps within the nappes, including anticlinal features, elevated thrust elements and unconformity traps beneath the Tertiary. Traps are sealed by associated fine-grained Tertiary rocks and impervious basement rocks.

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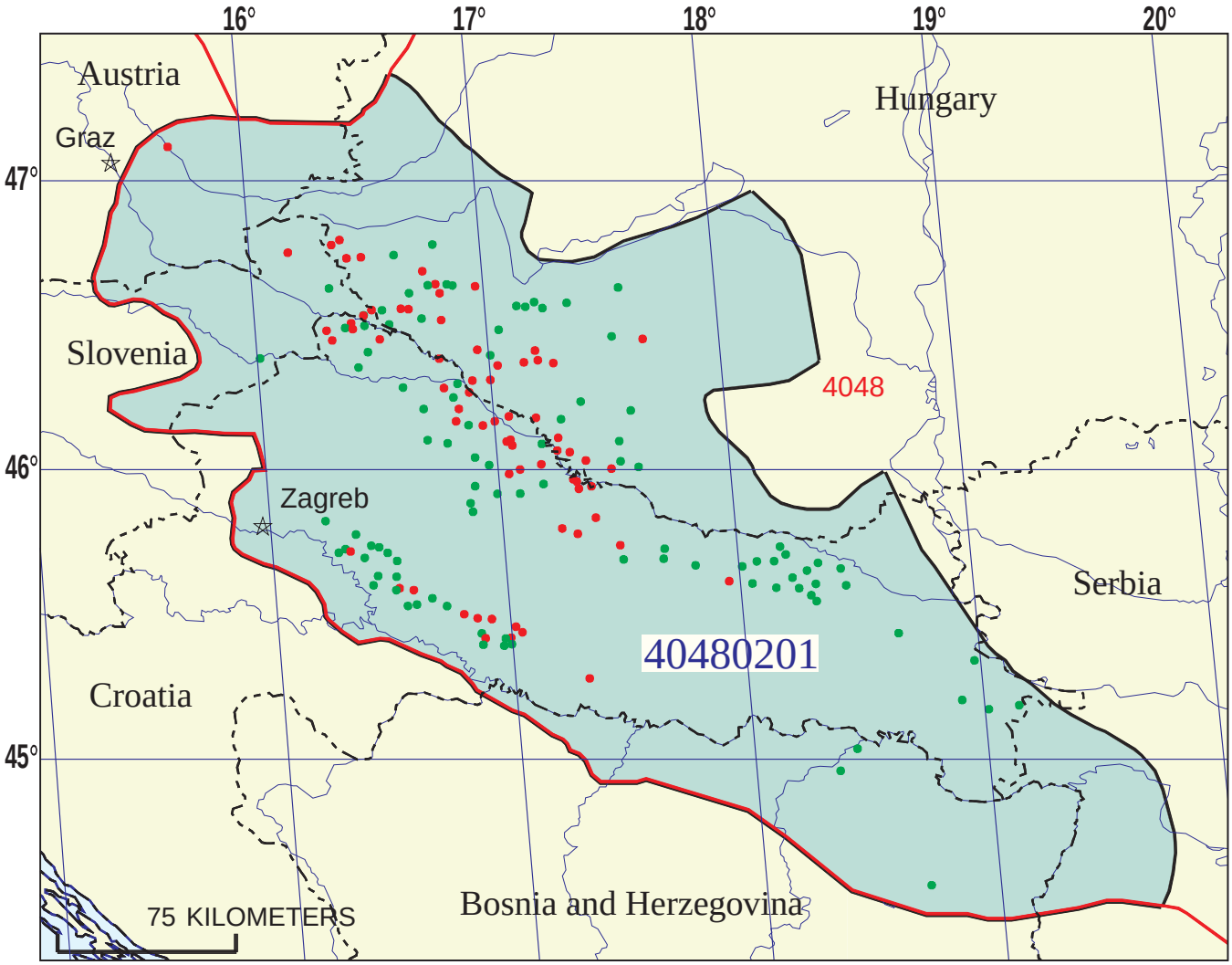


Zala-Drava-Sava Basins
Assessment Unit - 40480201

EXPLANATION

- Hydrography
- Shoreline
- 4048 — Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 40480201 — Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

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

Date:……..	6/1/99		
Assessment Geologist:……..	G.L. Dolton		
Region:……..	Europe	Number:	4
Province:……..	Pannonian Basin	Number:	4048
Priority or Boutique……	Priority		
Total Petroleum System:……	Zala-Drava-Sava Mesozoic/Neogene	Number:	404802
Assessment Unit:……	Zala-Drava-Sava Basins	Number:	40480201
* Notes from Assessor	Lower 48 growth factor.		

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (≥20,000 cfg/bo overall):… Oil

What is the minimum field size?……. 1 mmboe grown (≥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: 58 Gas: 46
Established (>13 fields) X Frontier (1-13 fields) _____ Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
1st 3rd 9.3 2nd 3rd 6.9 3rd 3rd 4.2
Median size (grown) of discovered gas fields (bcfg):
1st 3rd 19.2 2nd 3rd 53 3rd 3rd 19.1

Assessment-Unit Probabilities:

Attribute	Probability of occurrence (0-1.0)
1. **CHARGE:** Adequate petroleum charge for an undiscovered field ≥ minimum size……	1.0
2. **ROCKS:** Adequate reservoirs, traps, and seals for an undiscovered field ≥ minimum size……	1.0
3. **TIMING OF GEOLOGIC EVENTS:** Favorable timing for an undiscovered field ≥ minimum size	1.0

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

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

UNDISCOVERED FIELDS

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

Oil fields:……min. no. (>0)	10	median no.	25	max no.	50
Gas fields:……min. no. (>0)	15	median no.	30	max no.	60

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	50
Gas in gas fields (bcfg):……min. size	6	median size	20	max. size	500

Assessment Unit (name, no.)
Zala-Drava-Sava, 40480201

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……	500	1000	2000
NGL/gas ratio (bngl/mmcfg)……	20	40	60

Gas fields:	minimum	median	maximum
Liquids/gas ratio (bngl/mmcfg)……	10	30	50
Oil/gas ratio (bo/mmcfg)……			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS

(variations in the properties of undiscovered fields)

Oil Fields:	minimum	median	maximum
API gravity (degrees)……	10	35	50
Sulfur content of oil (%)……	0.3	0.5	1
Drilling Depth (m) ……	500	2000	3500
Depth (m) of water (if applicable)……			

Gas Fields:	minimum	median	maximum
Inert gas content (%)……	2	3	4
CO_2 content (%)……	0.5	7	78
Hydrogen-sulfide content (%)……			
Drilling Depth (m)……	500	2500	5000
Depth (m) of water (if applicable)……			

Assessment Unit (name, no.)
Zala-Drava-Sava, 40480201

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

1. Croatia represents 43 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		75	
Portion of volume % that is offshore (0-100%).....		0	

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		79	
Portion of volume % that is offshore (0-100%).....		0	

2. Hungary represents 26 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		25	
Portion of volume % that is offshore (0-100%).....		0	

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

3. Slovenia represents 6 areal % of the total assessment unit

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

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):.....			
Volume % in parcel (areal % x richness factor):...		1	
Portion of volume % that is offshore (0-100%).....		0	

4. Bosnia and Herzegovina represents 13 areal % of the total assessment unit

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

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

5. Austria represents 7 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		0	
Portion of volume % that is offshore (0-100%)……		0	

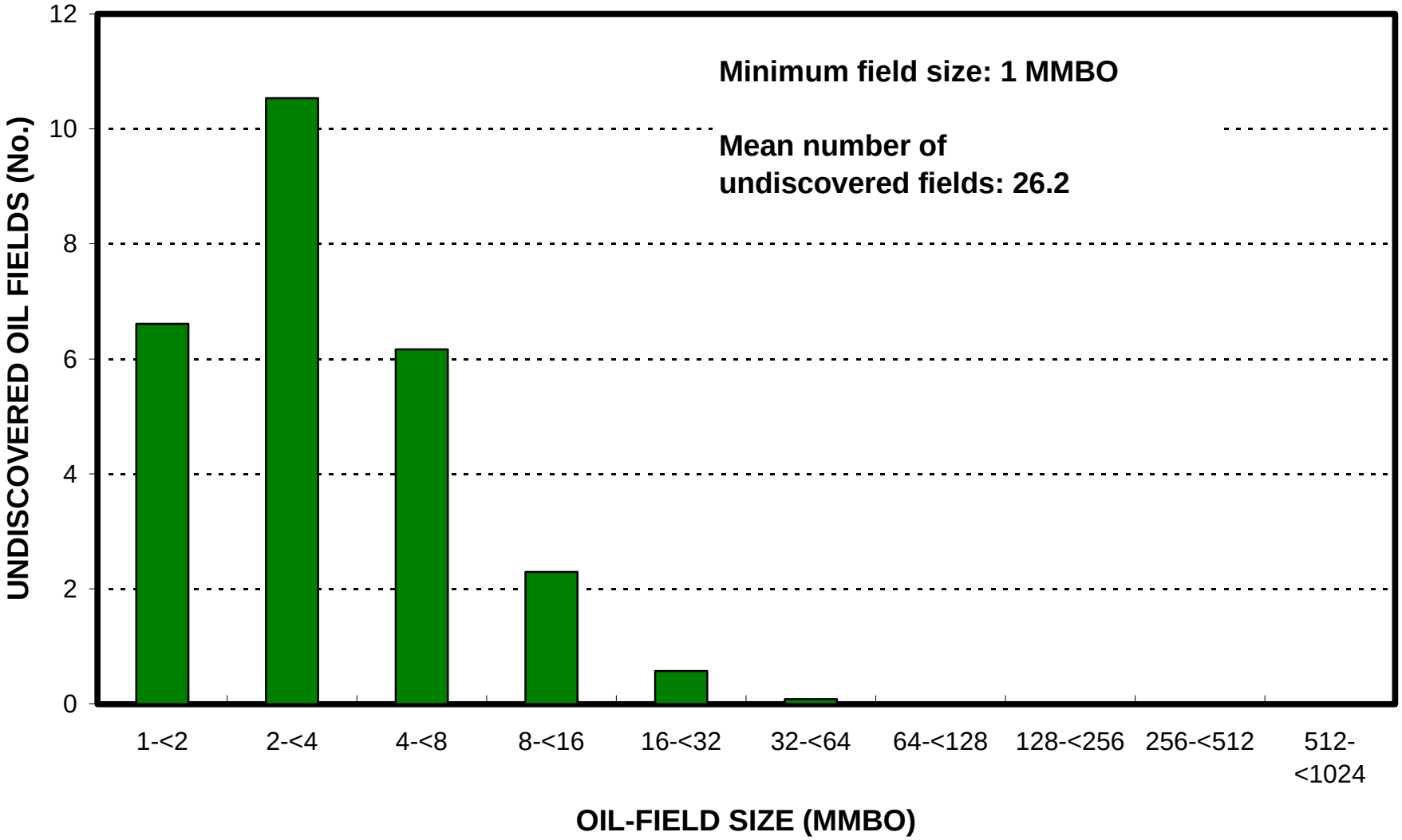
Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		0	
Portion of volume % that is offshore (0-100%)……		0	

6. Serbia and Montenegro represents 5 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		0	
Portion of volume % that is offshore (0-100%)……		0	

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		0	
Portion of volume % that is offshore (0-100%)……		0	

Zala-Drava-Sava Basins, AU 40480201
Undiscovered Field-Size Distribution



Zala-Drava-Sava Basins, AU 40480201
Undiscovered Field-Size Distribution