

THE PETROLEUM GEOLOGY OF THE PRECASPIAN BASIN

CONTENTS

EXECUTIVE SUMMARY

PART I: GEOLOGICAL DEVELOPMENT OF THE PRECASPIAN BASIN

1. Introduction to the Precaspian Basin

- I.1.1 Description of the report
- I.1.2 Brief description of the Precaspian Basin; its geography and climate
- I.1.3 Introduction to the petroleum geology and previous exploration history of the Precaspian Basin

2. Overview of the Geological Development of the Precaspian Basin

- I.2.1 Structural and tectonic development of the Precaspian Basin in its regional context
 - I.2.1.1 Early (pre-Devonian) development
 - I.2.1.2 Early and Middle Devonian development: the North Precaspian Rift
 - I.2.1.3 Late Devonian development: the southern margins
 - I.2.1.4 Carboniferous development: the Uralian orogeny
 - I.2.1.5 Mesozoic and younger development
- I.2.2 Depositional history of the Precaspian Basin
 - I.2.2.1 Devonian-Early Permian sedimentation
 - I.2.2.2 Mesozoic and younger sedimentation and halokinesis

3. Development of the Northern Margin of the Precaspian Basin

- I.3.1 Tectonic development of the northern margin
- I.3.2 Depositional history of the northern margin
 - Early Devonian*
 - Middle Devonian*
 - Late Devonian (Frasnian)*
 - Late Devonian (Famennian) to Kungurian*
 - Post-Kungurian (post-salt)*

4. Development of the Northwestern and Western (Pre-Volzhe) Margins of the Precaspian Basin

I.4.1 Tectonic development of the northwestern and western margins

Karakul'-Smushkov Thrust Zone

Sarpa Trough

I.4.2 Depositional history of the northwestern and western margins

Devonian to Early Bashkirian

Middle Carboniferous (Late Bashkirian to Early Moscovian)

Late Carboniferous to Early Permian (pre-Kungurian)

Kungurian

Post-Kungurian (post-salt)

5. Development of the Astrakhan Arch and Surrounding Areas

Devonian and Early Carboniferous

Bashkirian

Lower Permian

Post-salt succession

6. Development of the Eastern Margin of the Precaspian Basin

I.6.1 Tectonic development of the eastern margin

Novoalekseevsk Trough

I.6.2 Depositional history of the eastern margin

Ostansuk-Dzhurun section type

Temir Platform section type

Zhanazhol-Torkol section type

Laktybai-Kozhasai section type

Karaulkeldy-Aschisai section type

Kungurian

Post-salt succession

7. Development of the Southern and Southeastern Margins of the Precaspian Basin (excluding the Astrakhan Arch)

I.7.1 Tectonic development of the southern and southeastern margins

I.7.1.1 South Emba Thrust Zone

I.7.1.2 Primorsk Uplift Zone

I.7.1.3 Shchukatsk-North Caspian Uplift Zone

I.7.2 Depositional history of the southern and southeastern margins

I.7.2.1 Sub-salt (Palaeozoic) succession

Primorsk (Tengiz-Kashagan) Uplift Zone

South Emba section type

Urtatau-Sarybulak section type

Biikzhaal' section type

Summary of Late Devonian to Early Permian palaeogeography

I.7.2.2 Kungurian evaporites

I.7.2.3 Post-salt succession

Permo-Triassic

Jurassic

Cretaceous to Recent

8. Some Notes on Central Regions of the Precaspian Basin

PART II: PETROLEUM GEOLOGY OF THE PRECASPIAN BASIN

1. Outline of the Petroleum Geology of the Precaspian Basin

- II.1.1 Reservoirs, seals and traps
- II.1.2 Source rocks
- II.1.3 Hydrocarbon generation
- II.1.4 Hydrocarbon migration
- II.1.5 Hydrocarbon types

2. Petroleum Geology of the Northern Margin of the Precaspian Basin

- II.2.1 Reservoirs, seals & traps
 - Devonian (pre-Late Frasnian)*
 - Late Frasnian*
 - KT-3 to KT-1 carbonate platform deposits*
 - Seals*
 - Traps*

- II.2.2 Source rocks and hydrocarbon types

3. Petroleum Geology of the Northwestern and Western (Pre-Volzhe) margins of the Precaspian Basin

- II.3.1 Reservoirs, seals & traps
 - Lobodinsk-Teplov Uplift Zone*
 - Sarpa Trough*
 - Karakul'-Smushkov Thrust Zone and Karasal' Homocline*

- II.3.2 Source rocks and hydrocarbon types

4. Petroleum Geology of the Astrakhan Arch and Surrounding Areas

- II.4.1 Reservoirs, seals & traps

- II.4.2 Source rocks and hydrocarbon types

5. Petroleum Geology of the Eastern Margin of the Precaspian Basin

II.5.1 Reservoirs, seals & traps

Early Carboniferous (KT-3 equivalent)

KT-1 and KT-2

Asselian high-gamma unit

Asselian to Artinskian succession

II.5.2 Source rocks and hydrocarbon types

6. Petroleum Geology of the Southeastern and Southern Margins of the Precaspian Basin

II.6.1 Reservoirs, seals & traps

Sub-salt reservoirs

Post-salt reservoirs

II.6.2 Source rocks and hydrocarbon types

BIBLIOGRAPHY

ENCLOSURES

VOLUME 2: FIELD DATABASE OF THE PRECASPIAN BASIN

(Extract from Blackburn Geoconsulting's FSU Oil and Gas Field Database)

LIST OF FIGURES

- Figure I.1.1** General location map for the Precaspian Basin and surrounding areas.
- Figure I.2.1** Regional cross-sections of the Precaspian Basin based on seismic data.
- Figure I.3.1** Eifelian palaeogeography and thickness on the North Precaspian margin.
- Figure I.3.2** Givetian palaeogeography and thickness on the North Precaspian margin.
- Figure I.3.3** Late Frasnian palaeogeography on the North Precaspian margin.
- Figure I.3.4** Cross-section through the Devonian along line III-III'.
- Figure I.3.5** Simplified section showing stratigraphy over the Sol-Ilets'k Rise (line IV-IV').
- Figure I.3.6** Structure map, schematic cross sections and generalised stratigraphic section of the Teplov-Tokarevsk group of fields.
- Figure I.3.7** Correlation panel of key Devonian wells to the north of the Northern Precaspian Basin margin.
- Figure I.3.8** Cross-section through the Devonian across the Kamelik-Chagan and Tashlinsk zones of the Northern Precaspian.
- Figure I.3.9** Schematic cross-section along the Mednogorsky profile.
- Figure I.4.1** Schematic cross sections across the western part of the northern (a) and northwestern (b) margins of the Precaspian Basin.
- Figure I.4.2** Schematic section across the Karasal' Homocline.
- Figure I.4.3** Western Precaspian Basin: thickness of Middle Carboniferous clastic sediments and area of clinoform deposition.
- Figure I.4.4** Schematic stratigraphic correlation across the Western Precaspian Basin.
- Figure I.5.1** Schematic section through the Astrakhan Arch and the adjacent Karakul'-Smushkov Thrust Zone.

- Figure I.5.2** Devonian and older stratigraphy of the Devonskaya-2 well, Astrakhan Arch.
- Figure I.6.1** Geological section along part of the regional seismic profile 9104.
- Figure I.6.2** Schematic cross-section across the Temir Block.
- Figure I.6.3** Seismic profile from the Karaulkeldy Uplift to the Zhanazhol-Tortkol zone.
- Figure I.6.4** Schematic cross-section across the Kenkiyak-Zhanazhol zone.
- Figure I.6.5** Schematic cross-section through the Kozhasai-Zhanazhol zone.
- Figure I.7.1** Main structural elements, carbonate platforms and hydrocarbon fields along the southern margin of the Precaspian Basin.
- Figure I.7.2** Position of the North Caspian Gravity Anomaly with respect to the basement structure of the southern margin of the Precaspian Basin.
- Figure I.7.3** Schematic cross-sections across the southern margin of the Precaspian Basin at its junction with the Scythian and Turan platforms.
- Figure I.7.4** Interpreted seismic section across the southeastern margin of the Precaspian Basin.
- Figure I.7.5** Different types of cross-section through the Palaeozoic sequence on the southeastern margin of the Precaspian Basin.
- Figure I.7.6** Comparative Palaeozoic stratigraphies in the Southeastern Precaspian Basin.
- Figure I.7.7** Thickness and schematic facies distribution of Late Devonian-Early Visean sediments in the Southeastern Precaspian Basin.
- Figure I.7.8** Thickness and schematic facies distribution of Middle Visean sediments in the Southeastern Precaspian Basin.
- Figure I.7.9** Thickness and schematic facies distribution of Late Visean sediments in the Southeastern Precaspian Basin.

Figure I.7.10 Thickness and schematic facies distribution of Serpukhovian sediments in the Southeastern Precaspian Basin.

Figure I.7.11 Thickness and schematic facies distribution of Early Bashkirian sediments in the Southeastern Precaspian Basin.

Figure I.7.12 Thickness and schematic facies distribution of Artinskian sediments in the Southeastern Precaspian Basin.

Figure I.7.13 Middle to Late Triassic palaeogeography and thickness for the southern margin of the Precaspian Basin.

Figure I.7.14 Structure contour map on the top of the pre-Jurassic surface (Reflector V) and salt dome distribution along the southern margin of the Precaspian Basin.

Figure I.7.15 Latest Middle Jurassic (Callovian) palaeogeography and Middle Jurassic sediment thickness for the southern margin of the Precaspian Basin.

Figure I.7.16 Neocomian palaeogeography and Early Cretaceous thickness for the southern margin of the Precaspian Basin.

Figure I.7.17 Schematic correlation of stratigraphic sections across the southern margin of the Precaspian Basin.

Figure II.1.1 Burial curves for different regions of the Precaspian Basin.

Figure II.1.1 Burial curves for different regions of the Precaspian Basin.

Figure II.1.2 Examples of hypothetical post-salt prospects in the South Orenburg area.

Figure II.5.1 Seismic profile across the northern part of the Zharkamys Arch, Eastern Precaspian, illustrating different post-salt trap types.

LIST OF TABLES

Table 1 Precaspian Basin: Summary of Hydrocarbon Geology

LIST OF ENCLOSURES

- ENCLOSURE 1:** GENERAL MAP OF STRUCTURE AND NOMENCLATURE FOR THE PRECASPIAN BASIN AND SURROUNDING AREAS
- ENCLOSURE 2:** SIMPLIFIED CARTOON ILLUSTRATING THE FORMATION OF THE PRECASPIAN BASIN (PART CONJECTURAL)
- ENCLOSURE 3:** COMPARATIVE PALAEOZOIC STRATIGRAPHY OF THE PRECASPIAN BASIN
- ENCLOSURE 4:** PRECASPIAN BASIN: DEPTH STRUCTURE CONTOURS ON CONSOLIDATED BASEMENT
- ENCLOSURE 5:** PRECASPIAN BASIN: DEPTH STRUCTURE CONTOURS ON REFLECTING HORIZON P₃ (SARGAEV HORIZON, MIDDLE FRASNIAN, LATE DEVONIAN)
- ENCLOSURE 6:** PRECASPIAN BASIN: DEPTH STRUCTURE CONTOURS ON REFLECTOR P₁ (BASE-KUNGURAIAN)
- ENCLOSURE 7:** WESTERN PRECASPIAN BASIN: LOCATION MAP SHOWING MAJOR TECTONIC FEATURES AND DISTRIBUTION OF HYDROCARBON FIELDS