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DIAGENESIS OF THE MAIN DOLOMITE DEPOSITS FROM BMB OIL AND GAS FIELD AND ITS INFLUENCE ON RESERVOIR PROPERTIES

INTRODUCTION

The aim of this study was the interpretation of relationships between environments of depositions, processes of diagenesis and reservoir properties of the Main Dolomite deposits from Barnówko-Mostno-Buszewo area (this oil and gas field is located in the western part of Poland, on the Gorzów Block).

The analysed processes of diagenesis such as cementation, intensive dissolution, dolomitization, and tectonic fracturing of carbonates had a strong effect on the nowadays porosities and permeability.

The barrier and open lagoon deposits have the good reservoir properties.

METHODS

Three boreholes: Buszewo-10k, Buszewo-11 and Buszewo-13 have been selected for the diagenesis studies of rocks from BMB field.

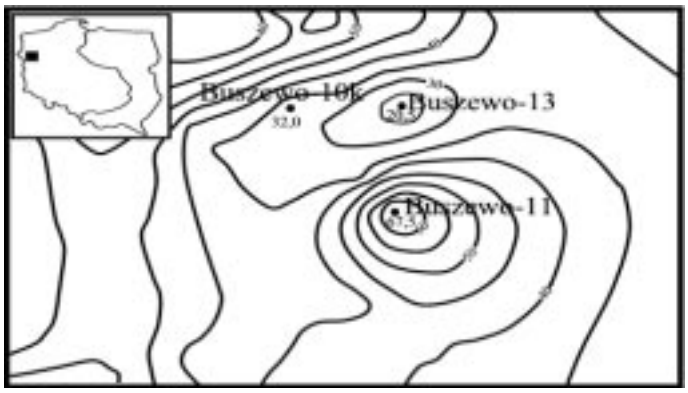

Fig.1. Thickness of the Main Dolomite deposits with location of the selected boreholes (after Szczawińska, 1999).

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The petrographic analyses were mainly based on observations of whole drills and microscopic studies of 150 thin sections. Thin sections were examined using transmitted light and cathodoluminescence (CL).

ENVIRONMENT OF DEPOSITS

Observed fabrics and carbonate components allowed to distinguish many environments characteristic for shallow carbonate platform: barrier, open lagoon, tidal flat, tidal channel, sebha.

In this paper only barier and open lagoon deposits are to be described.

The barrier deposits are represented by oncoids and ooids grainstones and packstones. Cross-stratification, keystones vuggs, horizons with influenced meteoric water can be observed.

The lagoon deposit is characterised by oncoids, peloids, intraclasts and bioclasts (brachiopods, bivalves, ostracods and foraminifers occur), packstones, wackstones and mudstones, algal bindstones. Algal layers, fenestral and geopetal fabrics, desiccation cracks, anhydrite beds, lenses, veins indicate on shallow-marine environments with high evaporation rates as well as the moderate and low energy environments.

The principal mineral deposits of barrier and open lagoon, in the examined boreholes, are dolomite, anhydrite, locally pyrite and fluorite.

Dolomites were created in two stages of dolomitizations (Gąsiewicz et. al., 1998). During first stage (early diagenetic) dolomitic micrite and microsparite (light red colour in CL) replaced primary aragonite and calcite crystals in carbonate grains. During second stage (late diagenetic) dolomitic microsparite and sparite (dark red colour in CL) were formed as anhedral, subhedral and rarely euhedral crystals. Second stage dolomite crystals occur as partial replacement of first stage dolomites and are filling pore spaces.

Anhydrites in studied drills have variable forms: beds, veines, lenses, bunches. In thin sections they have subhedral and euhedral forms (black colour in CL), occur as filling-cementing mass, partially replacing of carbonate crystals, filling pore spaces. They were formed in early and late stages of diagenesis.

Fluorite and pyrite form subhedral and euhedral crystals. They occur in vuggy, stylolites, often with accompaning bitumens.

DIAGENESIS

The primary porosities of sediments were destroyed during sedimentation and early diagenesis. Initially, subsequent to fluctuation of sea level, meteoric water has formed horizons with vadose compaction as well as strata of sediment with vadose cements: pendant and meniscus. Later, free pores have been reduced almost totally, as a result of meteoric and marine phreatic cementation (e.g. granular and syntaxial rim cements).

The secondary porosity developed during the stages of early and late diagenesis: 1) the aragonite ooids and some calcite oncoids have been leached, producing oomoldic porosity (Flűgel, 1982); 2) unevenly distributed process of dissolution of grains and cements as well as tectonic fracturing have formed vuggy and fractury porosity; 3) process of dolomitization of grains and cements formed intercrystalline porosity.

Locally, independently of primary features of the deposits, massive cementation of anhydrite and neomorphism processes influenced the deterioration of reservoir properties. Due to often lack of comunication between pores the permeability of the study deposits has decreased.

CONCLUSION

1) Diagenesis of the Main Dolomite deposits in the studied area was dominated by processes of cementation, dolomitization, dissolution and tectonic fracturing, which influenced their reservoir properties.

2) The barrier and open lagoon deposits are good bitumen collectors. They reveal good and very good porosity (common oomoldic, vuggy and fracture porosities) but simultaneously they have moderate and weak permeability (microporous character of pore spaces, horizons with massive cementation).

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