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Dolomite Types of the Asmari Formation in the Aghajari Oil Field and Their Effect on the Trend of Mercury Injection Curves

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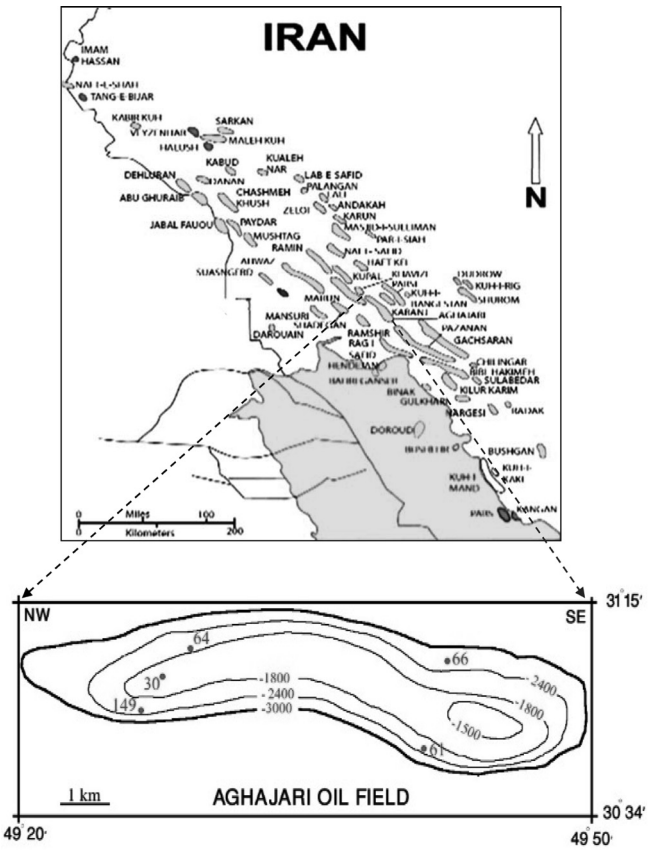
INTRODUCTION

Reservoir study and examination of the major parameters controlling reservoir qualities play considerable roles in producing a realistic picture of reservoir properties. In this context, carbonate reservoirs are more difficult to decipher for geologists and petroleum engineers due to the heterogeneity of reservoir characteristics [1], their commonly fractured nature and their complex diagenetic evolution [2]. In many oil fields located in the Middle-east and Iran, the amount of dolomitization and fracture densities determines hydrocarbon production from the reservoir rock [3]. There are a lot of published papers which are related to the role of dolomitization on the reservoir quality in Iran and the world [4-6]. Moreover, mercury injection is one of the best methods for measuring the capillary and permeability of a rock [7]. By considering the good reservoir quality of dolomitic zones in the Asmari Formation of the Aghajari oil field, this study will focus on dolomite types' detection and their effects on the trend of mercury injection curves. The results of this research can be useful in the development of the field, taking a decision and proper strategy in the connection of hydrocarbon production and recovery in the future of this field and similar fields.

GEOLOGICAL SETTINGS

The Aghajari oil field is located about 90 km south-east of Ahwaz (SW Iran) in the Dezful Embayment (Fig. 1). This oilfield extends from 49˚ 20' to 49˚ 50' E longitude, and 30˚ 34' to 31˚ 15' N latitude in the vicinity of other large hydrocarbon fields such as Pazanan and Marun [8]. The Asmari Formation in the Aghajari oil field, has been deposited in a homoclinal carbonate ramp. In addition, the formation has been affected by various diagenetic processes. Also, the thickness of the formation in the Aghajari oil field is about 380 meters [8].



Figuer 1: The location of the studied oil field in south-west Iran.

METHODOLOGY

This study is based on 1200 m cores from the five wells in the Aghajari oil field (Fig. 1). Cores have been analyzed for colour, presence of hydrocarbon and Archie classification [9] in macroscopic samples. In contrast, the classification of dolomites has been carried out based on Sibley and Gregg [10] and Fridman [11] in 2500 thin sections. Moreover, 10 samples of dolomites were studied by means of Scanning Electron Microscope (SEM) in Central laboratory of Ferdowsi University of Mashhad. Moreover, the next step was examining the reservoir characteristics of each types of dolomites by combining 7 SCAL (special core analyses) data with 7 RCA (routine core analyses) data to identify the dolomites with the best reservoir qualities in the oil field.

DISCUSSION AND RESULTS

Core studies, microscopic thin section and Scanning Electron Microscope images (SEM) from the 5 wells indicate that dolomitization is of the most effective diagenetic processes on the reservoir quality of the Asmari Formation and mainly effected on upper parts of this Formation. Moreover, five types of dolomites including Dolomicrite (<16 micron) (Fig. 2a), Dolomicrosparite (16-62 micron) (Fig. 2b), Dolosparite (>62 micron) (Fig. 2c), floated dolomites in the fine grain matrix (Fig. 2d), and dolomite cements (Fig. 2e) are recognizable. Each type of these dolomites have different effects on the trend of mercury injection curves (Pc) and therefore on the reservoir quality of the Asmari.

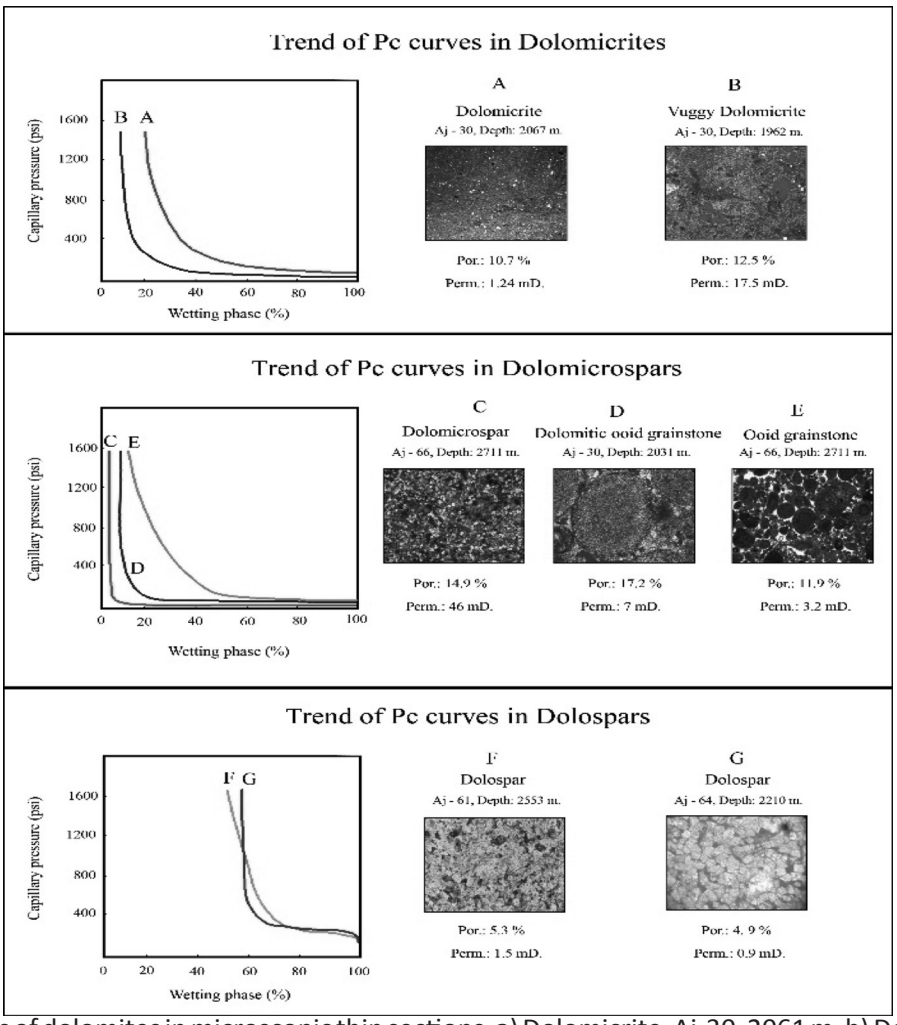


Figure 2: Types of dolomites in microscopic thin sections. a) Dolomicrite, Aj-30, 2061 m. b) Dolomicrospar, Aj- 66, 2710 m. c) Dolospar, Aj- 61, 2553 m. d) Floated dolomites in the fine grain matrix, Aj-30, 2051 m., e) Dolomite cement, Aj- 30, 1966 m. All photographs are taken with XPL.

Dolomicrospars are the most common type and have high porosity and permeability (average 16% and 35 mD. respectively) due to the presence of intercrystaline porosities. Therefore, they can saturate by mercury under low entry pressures (about 5 psi) and then show high-steep capillary pressure curves. Dolomicrites due to fine-grain nature, have initially high porosity and relatively low permeability (11.5% and 4 mD., respectively). But in along with dissolution, they show reservoir characteristics which are similar to Dolomicrospars and their Pc curves shift to the left. In addition, floated dolomites in matrix have no considerable role on the reservoir quality. Dolospars due to over-dolomitization and locking of dolomite crystals, and dolomite cements due to disconnecting of pore spaces led to a decrease in porosity and permeability (Fig. 3).

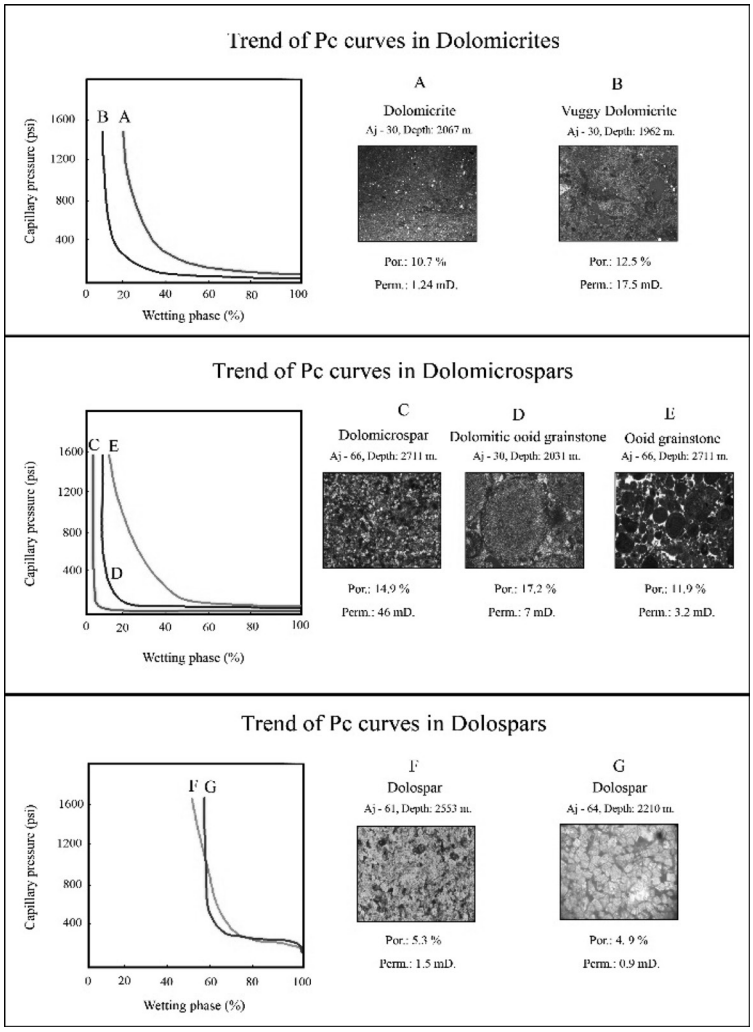


Figure 3: Trends of Pc curves in types of dolomites.

CONCLUSION

Based on the study of 1200-meter core, the petrography of 2500 microscopic thin sections along with 7 SCAL and 7 RCA, five types of dolomites including dolomicrite, dolomicrospar, dolospar, floated dolomite in the fine grain matrix and cement dolomite were recognized. Each type of these dolomites have different effects on the trend of mercury injection curves and therefore on the reservoir quality of the Asmari. Dolomicrospars are the most common type and have high porosity and permeability due to the presence of intercrystaline porosities. Moreover, dolomicrites due to fine-grain naturehave initially high porosity and relatively low permeability. But in along with dissolution, they show reservoir characteristics similar to Dolomicrospars and their Pc curves are shifted to the left. Floated dolomites in matrix have no considerable role on the reservoir quality. Dolospars due to over-dolomitization and locking of dolomite crystals, and dolomite cements due to disconnecting of pore spaces led to a decrease in porosity and permeability. It seems zones 1 - 3 of the Asmari Formation in the Aghajari oil field have more potential for drilling and well-completion in the future because of more concentration of dolomicrospars and vuggy dolomicrites.

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