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Procedia Earth and Planetary Science 7 (2013) 31 – 35

Procedia
Earth and Planetary Science

Water Rock Interaction [WRI 14]

Application of geochemical data as evidence of water-rock interaction in the Sarvak formation, Izeh Zone, Zagros, Iran

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Abstract

The Sarvak formation from the Bangestan group is an important petroleum reservoir in Iran that we studied geochemically in 5 outcrop sections in the Izeh zone. Our results show that characteristics of the Sarvak Formation changed in the Izeh zone. High Sr/Mn ratios and Sr content with heaviest oxygen isotopes of the Sarvak Formation carbonates indicate lower dissolution processes, extensive rock-water interaction (WRI), and a closed diagenetic system. O and C isotope variations suggest marine phreatic diagenesis in the north flank of the Mish, Bangestan, and Mangasht anticlines, and meteoric diagenesis in the south flank of the Mish and Payun anticlines. Observed geochemical variations in the Izeh zone can be related to reactivation of deep-seated structures and faults that caused variation in thickness, facies, and diagenesis.

Keywords: geochemistry; trace and major elements; carbon and oxygen isotopes; water-rock interaction; Sarvak formation.

1. Introduction

The Middle Cretaceous Sarvak Formation of Albian to Turonian age in southern Iran contains more than 20% oil-in-place, forming the second most important reservoir rocks after the Asmari Formation of Oligo-Miocene. In addition to its petroleum significance, the Sarvak Formation forms productive ground water aquifers feeding karstic springs in the Zagros region. The aim of this study is to examine geochemical characteristics of Sarvak carbonates; thus 154 and 63 samples were analyzed for elemental and isotopic studies respectively in 5 outcrops in the Izeh zone, for better understanding of sedimentary

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doi:10.1016/j.proeps.2013.03.216

characteristics in the Zagros area of Iran as main targets for hydrocarbon exploration.

2. Geological Setting

Five outcrop sections with a total thickness of 2338 m, including: Bangestan anticline as a type section, Mangasht, Payun, north and south flanks of Mish anticlines which are situated in the Izeh zone, Zagros fold-thrust belt were selected for study (Fig.1). The Zagros fold-and-thrust belt can be divided into a number of zones (Lurestan, Izeh, Dezful Embayment, Fars, High Zagros), which differ according to their structural style and sedimentary history. The Izeh zone lies across a sharp topographical break to the southwest of the High Zagros fault. This zone consists of a variety of structures of variable sizes and geometric characteristics [1, 2]. The boundary of the Izeh zone coincides with the Balarud, Kazerun, Mountain Front and High Zagros Faults. The Hendijan-Izeh fault is an important lineament in the Arabian tectonic trend and corresponds to a syncline structure in the Arabian plate.

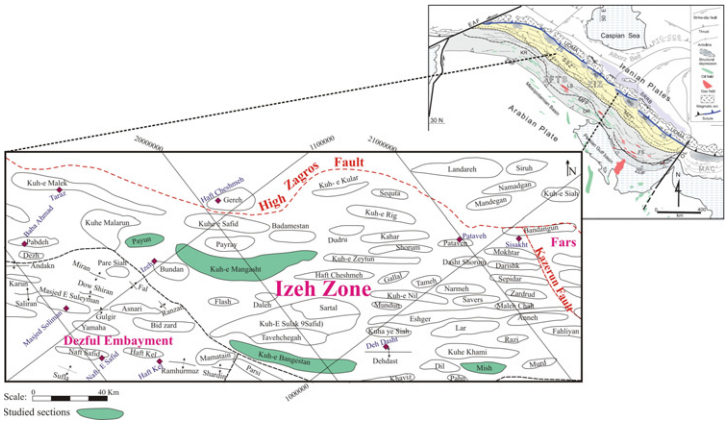

Fig. 1. Subdivisions of the Zagros orogenic belt [2] and location map of studied outcrops.

3. Geochemical data and discussion

Study of the major elements (Ca, Mg), trace elements (Sr, Na, Fe, Mn) and C and O isotopes of Sarvak limestone can help us understand geochemical and diagenetic characteristics of carbonate rocks in the Izeh zone. Variation of Sr versus Na and Mn are illustrated in fig.2. As seen in these figures the variation of Na in Sarvak carbonate samples of Payun and Bangestan are less than other samples (>200 ppm). While, Sarvak limestones in Mish anticline show high ranges of Na (200-700 ppm) compared to other sections. The average Na in Mangasht is less than 300 ppm. The Sr content in North flank of Mish and a number of Bangestan and Mangasht samples are higher than South flank of Mish and Payun anticlines [3-6]. Differences in original carbonate mineralogy, facies distribution, salinity, biological fractionation and depth of basin during deposition of Sarvak carbonates might cause the Sr and Na variation observed in outcrops in the Izeh zone, Zagros area. The incorporation of Mn into marine carbonates depends on the primary mineralogy, rate of precipitation, and the concentration of Mn in seawater [7]. The Mn amount in Sarvak carbonates of Mangasht anticline are higher than other sections due to more reducing conditions and more dissolution or alteration of this section (Fig.2 B&C). Bathurst [8] suggested that limestone diagenesis is mainly a wet dissolution and reprecipitation process. This process is greatly facilitated by subaerial exposure and fresh water influx, resulting in low Sr/Mn ratios. Therefore, covariance of Sr/Mn with Mn provides a useful measure of the degree of dissolution in limestone. The Plot of Sr/Mn vs. Mn