



Sedimentary facies and diagenetic features of the Early Cretaceous Fahliyan Formation in the Zagros Fold-Thrust Belt, Iran



Mohammad Sahraeyan^{a,*}, Mohammad Bahrami^b, Mohammad Hooshmand^c, Shahid Ghazi^{d,e}, Ali Ismail Al-Juboury^f

^a Department of Geology, Khorasgan (Esfahan) Branch, Islamic Azad University, Esfahan, Iran

^b Department of Geology, Science and Research Branch, Islamic Azad University, Shiraz, Iran

^c Department of Geology, North Tehran Branch, Islamic Azad University, Tehran, Iran

^d School of Earth and Environment, University of Leeds, Leeds LS2 9JT, UK

^e Institute of Geology, Punjab University, Quaid-e-Azam Campus, Lahore 54590, Pakistan

^f Geology Department, Mosul University, Mosul, Iraq

ARTICLE INFO

Article history:

Received 5 February 2013

Received in revised form 7 July 2013

Accepted 12 July 2013

Available online 23 July 2013

Keywords:

Microfacies
Carbonate ramp
Calcareous algae
Benthic foraminifera
Fahliyan Formation

ABSTRACT

The Early Cretaceous Fahliyan Formation (middle part of the Khami Group), is one of the important reservoir rocks in the Zagros Fold-Thrust Belt. The Zagros Fold-Thrust Belt is located on the boundary between the Arabian and Eurasian lithospheric plates and formed from collision between Eurasia and advancing Arabia during the Cenozoic. In this study area, the Fahliyan Formation with a thickness of 325 m, consists of carbonate rocks (limestone and dolomite). This formation overlies the Late Jurassic Surmeh Formation unconformably and underlies the Early Cretaceous Gadvan Formation conformably at Gadvan Anticline. The formation was investigated by a detailed petrographic analysis to clarify the depositional facies, sedimentary environments and diagenetic features in the Gadvan Anticline. Petrographic studies led to recognition of the 12 microfacies that were deposited in four facies belts: tidal flat, lagoon, and shoal in inner ramp and shallow open marine in mid-ramp environments. The absence of turbidite deposits, reefal facies, and gradual facies changes show that the Fahliyan Formation was deposited on a carbonate ramp. Calcareous algae and benthic foraminifera are abundant in the shallow marine carbonates of the Fahliyan Formation. The diagenetic settings favored production of a variety of features which include cements from early to late marine cements, micritization, dolomitization, compaction features, dissolution fabric, and pores. The diagenetic sequence can be roughly divided into three stages: (1) eugenic stage: marine diagenetic environment, (2) mesogenic stage: burial environment, and (3) telogenic stage: meteoric diagenetic environment.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

The Mesozoic carbonate systems of the Arabian Plate, one of the richest hydrocarbon provinces of the world are mostly caused by the combination of their large-scale dimensions and source rock, reservoir rock, and seal rock in the same depositional system (Murriss, 1980). The remarkable concentration of the fundamental ingredients of a petroleum system is a large extent, caused by the repeated formation of organic-rich shallow basins on the northeast of Arabian Plate. Their formation in large carbonate platform successions assured significant source rock deposition in immediate contact with potential reservoir facies (van Buchem et al., 2002). The type section of the Fahliyan Formation is situated on the southern flank of Kuh-e Dal, near the Fahliyan Village (about

10 km north of Nourabad Mamasani City), in the Zagros Fold-Thrust Belt. The Fahliyan Formation is widespread in the Zagros Fold-Thrust Belt (Fig. 1) and consists of massive oolitic to pelletal limestone with minor contemporaneous brecciation in the basal part of the type section (James and Wynd, 1965). Variation in relative sea level led to deposition of two, third-order sequences in the type section with sequence boundary types I and II in this formation with Neocomian age (Adabi et al., 2010). Limestone sequences of the Sulaiy and Yamama formations in Saudi Arabia/Iraq, the Minagish Formation in Kuwait, and the Ratawi Formation in Kuwait/Iraq are the equivalents of the Fahliyan Formation (Christian, 1997).

Since there are not any studies on the sedimentary facies and diagenetic features of the Fahliyan Formation in the Gadvan Anticline, the aim of this paper is to determine the main microfacies, interpret the depositional environments and diagenetic features of the Fahliyan Formation deposits.

* Corresponding author.

E-mail address: m.sahraeyan@yahoo.com (M. Sahraeyan).

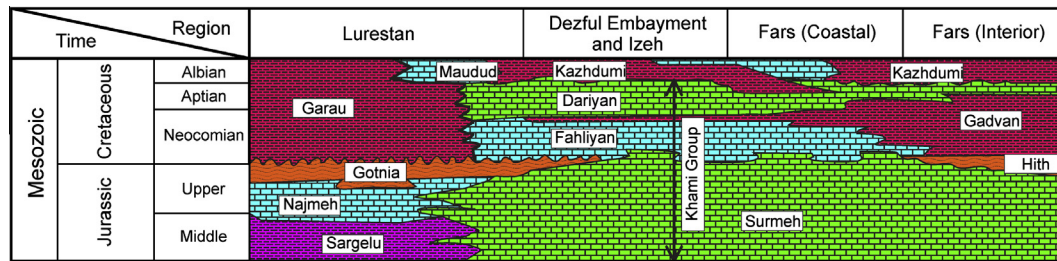


Fig. 1. Lithostratigraphic chart of the Mesozoic of the Zagros Basin (after James and Wynd, 1965).

2. Geological setting

The Gadvan Anticline is located in Fars Salient in the south of Zagros Fold-Thrust Belt (ZFTB) (Fig. 2). The ZFTB in Iran forms the external part of the Zagros active orogenic wedge. It includes a heterogeneous sequence of the latest Neoproterozoic–Phanerozoic sedimentary cover strata, about 7–12 km thick (Alavi, 2007).

The ZFTB is the deformed state of the Zagros Basin that is extended over the northeastern Afro-Arabian continental margin and is affected by the Early Cretaceous to present Zagros Orogeny. The ZFTB, as the external part of the Zagros Orogen (Alavi, 1980, 1994), extends southeast for nearly 2000 km from southeastern Turkey through northern Syria and northeastern Iraq to western and southern Iran. The northwestern boundary of the Zagros Fold-Thrust Belt is chosen to be the East Anatolian Strike-Slip Fault (EAF) in southeastern Turkey and the southeastern boundary of the Oman Line (Falcon, 1969).

The Zagros Orogen consists of three distinctive parallel tectonic zones, which from the northeast to the southwest are: Urumieh-Dokhtar Magmatic Assemblage (UDMA), Zagros Imbricate Zone (ZIZ), and Zagros Fold-Thrust Belt (ZFTB). The ZFTB (the Zagros Simple Folded Zone of (Falcon, 1974), with an average width of 300 km, extends parallel and to the southwest of the ZIZ. It constitutes the external (hence less-strained) part of the orogen. In contrast to the ZIZ, in which exposed structures are predominantly thrust faults, the ZFTB is distinguished by its long (up to 150–200 km), en echelon, and whaleback anticlines, which are spectacularly displayed on satellite images (Alavi, 2007). The salients and recesses of the ZFTB from southeast to northwest are as follow: Fars salient, Dezful recess (formerly Dezful Embayment), and Lorestan salient in Iran, and Kirkuk recess (Kirkuk Embayment) in Iraq (Alavi, 2004, 2007).

3. Study area and methodology

The study area is located at the northeast of Gadvan Anticline, about 45 km northeast of Shiraz in the Zagros Fold-Thrust Belt (Fig. 3). The Fahliyan Formation in Gadvan Anticline (29°37'15"N, 52°58'40"E) overlies the carbonates of the Late Jurassic Surmeh Formation with an unconformable contact (Fig. 4a) and underlies the Early Cretaceous Gadvan Formation conformably (Fig. 4b). This formation in the Gadvan Anticline consists of 325 m limestone and dolomite (Fig. 5).

Field studies, petrography and microfacies analysis were carried out on Gadvan Anticline outcrop section and 125 samples were prepared. For petrographic analysis, the grain and matrix percentages were estimated using visual percentage charts (Flügel, 1982). (Dunham, 1962) classification was used for carbonate facies nomenclature. The (Wilson, 1975) and (Flügel, 2010) facies belts nomenclature and sedimentary models were applied. Facies types and depositional setting were interpreted based on analysis of matrix and grains, compositional, textural fabric, fossil content,

energy index classification, and sedimentary data by comparison with modern environments (e.g., Flügel, 2010; Tucker and Wright, 1990; Wilson, 1975). Abundance of large benthic foraminifera, green algae, sponge spicules, mollusks, echinoderms, and non-skeletal grains (e.g., ooids, intraclasts, peloids, and aggregate grains) were considered. Sedimentologic textures and structures were considered qualitatively.

4. Lithology

The Fahliyan Formation in the study area consists of five units. Unit 1 with a thickness of 55 m consists of thick-bedded or massive dark gray limestone (grainstone and packstone; Fig. 5). The rocks contain skeletal grains of various groups, including calcareous algae, foraminifers, brachiopods, mollusks, and echinoderms. Unit 2, with a thickness of 95 m is composed of dark gray limestone in the lower part and thin- to medium-bedded dolostone in the upper part. Most of the rocks were originally composed of coarse-grained carbonate. The lower limestone generally appears medium to thick bedded and coarse grained with a packstone texture. Common fossil constituents are calcareous algae, foraminifers, echinoderms, and mollusks. Unit 3, with a thickness of 50 m is composed of thin- to medium-bedded limestone and is rich in large fossils. Fossil constituents are calcareous algae, foraminifers, mollusks, and echinoderms. Unit 4, with a thickness of 92 m consists of very thick-bedded limestone with a packstone texture. Many horizons have facies abundant in peloids, which often have a microstructure resembling that of calcareous algae. Upward, the packstone facies tends to dominate, and fossil components decrease in both abundance and diversity. Unit 5, with a thickness of 33 m is composed of thin-bedded limestone (wackestone) with calcareous algae, foraminifers, mollusks, and radiolarians.

5. Facies analysis and depositional environment

Thickness of the Fahliyan Formation in the Gadvan Anticline is 325 m and consists of carbonate rocks with a high variety of skeletal and non-skeletal grains, calcite cements, micrite, and late diagenetic dolomites. Based on lithology, textures and fossil contents of outcrop samples from the study area, there are 12 microfacies types in the Fahliyan Formation. Four main facies belts were distinguished from distal to proximal, these are: shallow open-marine, shoal, lagoon, and tidal flat. These facies belts are described briefly below:

5.1. Shallow open-marine facies belt

This facies belt comprises mudstone, sponge spicule wackestone, sponge spicule-echinoderm wackestone, and bioclast-sponge spicule wackestone. Bioclasts are mainly composed of sponge spicules and echinoid/crinoid remains. Subordinate constituents are thin-shelled bivalves, benthic foraminifera, and dasycladacean algal

Download English Version:

<https://daneshyari.com/en/article/4728898>

Download Persian Version:

<https://daneshyari.com/article/4728898>

[Daneshyari.com](https://daneshyari.com)