Summer 2020, Vol 10 (2): 193-207 J. Adv. Appl. Geol. OPEN ACCESS

New findings on sequence stratigraphy of the Ruteh Formation in the North of Central Alborz

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Keywords: Sequence stratigraphy, Homoclinal ramp, Ruteh Formation, Sedimentary environment, Epicontinental platform

1-Introduction

Based on the sedimentary sequence, magmatism, metamorphism, tectonic setting, and intensity of deformation, the Iranian Plateau has been subdivided into eight continental fragments, including Zagros, Sanandaj-Sirjan, Urumieh-Dokhtar, Central Iran, Alborz, Kopeh-Dagh, Lut, and Makran (Heydari et al., 2003). The sedimentary sequence of the Late Devonian to the Late Triassic of the Alborz is deposited in the passive southern margin of the Paleo-Tethys ocean floor (GhasemiNejad, 2002; Rahimi, 2002). The outcrops of the Ruteh Formation extend in the Alborz Mountains, but due to changes in the deposits, erosion, and operation of the faults, these deposits are different in various regions with different ages and thicknesses. This paper reports a sedimentological study, a description of microfacies, and the palaeoenvironmental reconstruction of the carbonate of the Ruteh Formation south of Amol. This formation south of the Amol surface section covers the sandstone of the Lower Permian Dorud Formation with unconformable contact. It is overlain by the Upper Permian Nesen Formation conformably. On the basis of the distribution of foraminifera, the Ruteh Formation is considered to be Late Morgabian-Late Julfian in age.

2-Methodology

The Ruteh Formation is 642 m thick in the area. The section was measured bed by the bed, and 200 samples were taken. Petrography and microfacies of carbonate rocks were described based on Dunham (1962) and Embry and Klovan (1971), and naming of clastic rocks bases on Pettijohn et al. (1987). Analyses have allowed the interpretation of marine carbonate environments, depositional system tracts, sea-level changes, and stratigraphic sequence architectures of Ruteh Formation in the study area.

3- Results and discussion

Facies associations of the Ruteh Formation eighteen facies in tidal flat, lagoon, shoal, and shallow open marine were distinguished in the Ruteh Formation of studied section. Of these microfacies, fourteen belong to the inner ramp, and four are located in the mid ramp, which indicates the warm shallow marine condition.
The tidal flat facies association composes of three microfacies, including Dolomite, Sandy mudstone, and peloidgrainstone.
The lagoon facies association contains three microfacies: bioclast, algal wackestone / packstone, foraminifera, algal wackestone / packstone, and foraminiferawackestone / packstone.

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DOI: 10.22055/AAG.2019.30273.2014
Received 2019-07-11
Accepted 2019-11-12

The shoal facies association contains eight microfacies, which are peloid algal packstone / grainstone, peloidbioclastpackstone / grainstone, bioclastostracodpackstone, bioclastbryozoagrainstone, bioclasttubiphytesgrainstone, bioclast crinoid packstone, bioclastpackstone / grainstone and phylloid algae bindstone.

The shallow open-marine faciesassociation from proximal to distal environments consist of gymnocodiaceaewackestone, Peloidgymnocodiaceaewackestone / packstone, bioclast, gymnocodiaceaewackestone / packstone, and bioclastwackestone.

The presence of mentioned bioclasts in the carbonate rocks of the Ruteh Formation in the south of Amolsection shows the persistence of shallow warm-water sub-tropical depositional setting throughout the deposition of this formation. Pieces of evidence such as the absence of tidal flat deposits, gradual facies changes, and abundant micrites indicate that the Ruteh Formation was deposited in a homoclinalcarbonate ramp environment (Fig.2). Unrecognized calciturbidite, gravel flow deposits, barrier reefs, and low sedimentation rate can be reasons for the homoclinalramp environment (Wilson, 1975; Read, 1985).

Sequence stratigraphic analyses interpreted six third-order depositional sequences in the south of the Amol section of Ruteh Formation.

The sequence one is 75m thick and Late Murgabian in age. This sequence can be divided into TST and HST. The tidal flatbeds of the microfacies on the inner ramp are the basal part of sequence 1which has been deposited unconformably on the sandstone beds Doroud Formation. The TST is characterized by the packstone, grainstone of the shoal environment.

The sequence 2 is 126 m thick and Early Midian in age. This sequence can be divided into TST and HST. The shoal carbonate rocks are interpreted as transgressive deposits formed during a period of sea-level rise as a TST. Bioclast, gymnocodiaceaewackestone / packstone, and Bioclastwackestone of the open marine fauna show an increase, and rising sea level changes reach a maximum, equivalent to the MFS. The bioclast, ostracodpackstone, bioclast, bryozoagrainstone of the microfacies shoal overlies the MFS.

Sequence 3 is approximately 96 m thick and Early-Middle Median in age. The open marine microfacies in the basal part of the sequence three is interpreted as TST. This depositional package's upper bed is a gymnocodiaceaewackestone / packstone and bioclastwackestone and indicates the MFS. The sediments of the lagoon environments (Microfaciesbioclast, algal wackestone / packstone,) overlying the MFS indicate the HST.

The depositional sequence 4 is present 100 m thick and Late median in age. The basal part of sequence four is interpreted as the TST. This depositional system includes carbonate deposits of the microfacies Gymnocodiaceaewackestone, peloid, gymnocodiaceaewackestone / packstone deposited in the open marine paleoenvironment. The upper bed of this depositional package is coral Bioclastwackestone and indicates the MFS. The HST has an aggradational stacking pattern deposited in the open marine and shoal paleoenvironments of the microfacies Gymnocodiaceaewackestone, Peloid, and Peloid, algal packstone/grainstone.

The depositional sequence five formed during the early period and is 141 m thick. At this sequence, the TST comprise of tidal flat to open marine deposits. An increase in third-order accommodation space is indicated by shallow lagoonalfacies overlain by shallow-open marine facies. Wackestone with abundant gymnocodiaceae represents deep-water facies; this is, therefore, interpreted as the MFS. An upward-shallowingfacies trend (HST) is indicated by shoal facies, overlain by shallow-lagoonalfacies.

The sequence 6 is Late Julfian in age and is present 107 m thick. The basal part of sequence six is interpreted as the TST. This depositional system includes deposits of the microfacies dolomite, sandy mudstone and peloidgrainstonebioclast algal wackestone / packstone, foraminifera algal wackestone / packstone and foraminifera deposited in the tidal flat and lagoon paleoenvironments. The upper bed of this depositional package is gymnocodiaceaewackestone / packstone and indicates the MFS. The HST has been deposited in the back reef, open lagoon, and lagoon paleoenvironments of the microfacies crinoid packstone, bioclastpackstone/grainstone, phylloid algae bind stone and algal wackestone / packstone, foraminifera, algal wackestone / packstone. The Nessen Formation overlies this sequence.

4-Conclusion

The Ruteh Formation is a shallow warm-water sequence of the mid to late Permian in age, overlies the Dorud sandstone, and is overlain by the Nesen Formation. In south Amol, the Ruteh Formation consists of 18 microfacies in open-marine, shoal, lagoon, and tidal flat facies belts deposited on a homoclinic carbonate ramp. Based on the sequence stratigraphic architecture, six third-order sequences have been recognized in the Ruteh Formation section.

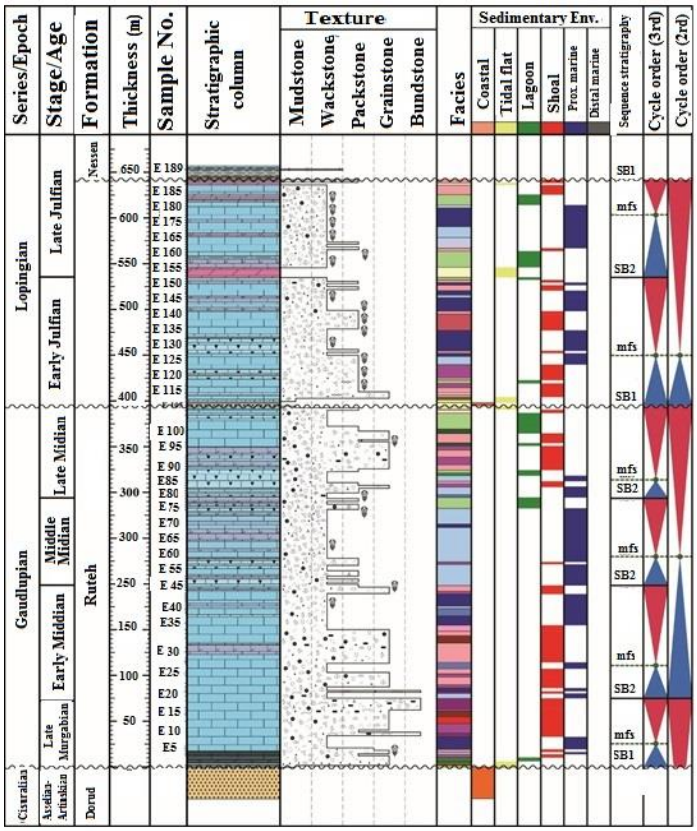

Fig. 1. Microfacies and sequence stratigraphy of the Ruteh Formation at study section.

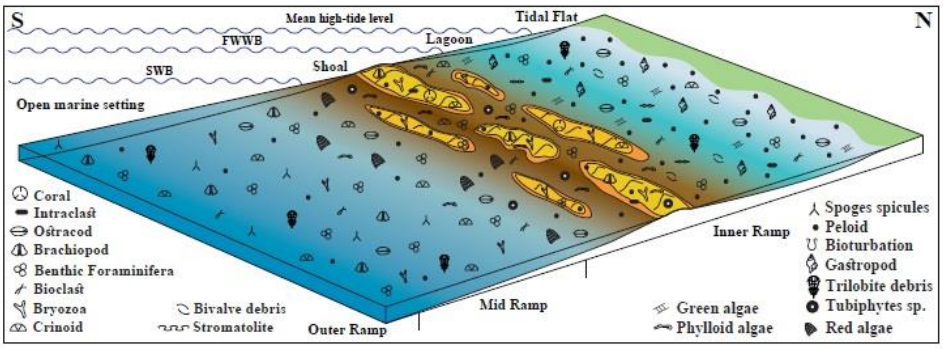

Fig. 2. Depositional model of the Ruteh Formation at the Central Alborz, adopted from Burchette and Wright (1992).

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