Biostratigraphy and palaeoecology of the Asmari Formation in Kuh-e-Siah anticline (north of Dehdasht) and correlation with the adjacent areas

Zare, M.[1]*, Vaziri-Moghaddam, H.[2], Taheri, A.[3], Ghabeishavi, A.[4]

1- M.Sc in Stratigraphy & Paleontology, Department of Geology, Faculty of Sciences, University of Isfahan, Isfahan, Iran
2- Professor, Department of Geology, Faculty of Sciences, University of Isfahan, Isfahan, Iran
3- Professor, Geology Department, Faculty of Earth Science, Shahrood University of Technology, Shahrood, Iran
4- National Iranian South Oil Company (NISOC), Ahwaz, Iran.

*m.zare201188@yahoo.com

Introduction

The Asmari Formation is one of the most prolific reservoirs in southwest Iran. It was deposited on a carbonate platform that was developed across the Zagros Basin. Biostratigraphic zonation of the Asmari Formation was first established by Wynd (1965). Recently, Laursen *et al*. (2009) and van Buchem *et al*. (2010), based on the foraminifera associations calibrated with strontium isotope stratigraphy, introduced a new biozonation for the Asmari Formation. Some recent published research on palaeoecology and biostratigraphy of the Asmari Formation are: Laursen *et al*. (2009), Vaziri-Moghaddam *et al*., (2010), van Buchem *et al*. (2010), Mossadegh *et al*. (2009), Rahmani *et al*. (2009) and Allahkarampour Dill *et al*. (2012).

Discussion

The thickness of the Asmari Formation in the study area is about 214.5 meter. 23 genera and 20 species of larger foraminifera have been identified in the studied section and based on their distribution, 3 foraminiferal assemblages are identified. The assemblage 1 corresponds to the biozone 3 (*Lepidocyclina- Operculina- Ditrupa*) of Laursen *et al*., (2009; Table1) and suggests a Late Chattian age. Assemblage 2 represents the *Miogypsina-Elphidium* sp. 14- *Peneroplis farsenensis* Assemblage Zone with the Aquitanian age (biozone 5 of Laursen *et al*., 2009). Biota of Assemblage 3 is correlated with *Borelis melo curdica* - *Borelis melo melo* Assemblage Zone of Laursen *et al*., (2009) and is attributed to the Burdigalian. The distribution of larger foraminifera appears to have largely depend upon light, salinity, temperature, substrate and water turbulence (Romero *et al*., 2002).

Salinity: According to distribution of diverse biota in the Asmari Formation, 3 different lithofacies identified that have been deposited under different salinity conditions in marine environment. The first one is normal water salinity microfacies (34-40 psu) and includes MF1 to MF4 which are characterized by diverse large benthic foraminifera (e.g. *Heterostegina*, *Spiroclypeus*, *Neorotalia* and *Miogypsinoides*) (Logan, 1959). The second one has water salinity between 40 to 50 psu and comprises porcelaneous benthic foraminifera (miliolids, *Peneroplis*, *Dendritina* and *Borelis*) and includes MF7 and MF8. The third one deposited under salinity more than 50 psu and represent by MF9 to MF 11 which form a higher percent in the sequence with low diversity of porcelaneous benthic foraminifera.

Light: Based on the light-dependency of particular organisms, a number of zones can be recognized in the Asmari Formation ranging from euphotic, mesophotic, oligophotic and aphotic (Pomar, 2001).

Nutrients: Nutrient supply is a basic palaeoecological control on biotic communities. Nutrient gradients in marine environments are classified as: oligotrophic, mesotrophic, eutrophic and hypertrophic (Hallock, 2001; Mutti & Hallock, 2003; Pomar *et al*., 2004). The Asmari Formation in the study area was mainly deposited under mosotropic to oligotrophic conditions.

Carbonate grain associations: The Asmari Formation in kuh-e Siah anticline formed in the inner, middle and outer carbonate ramp setting. Three faunal grain assemblages (foramol, foralgal and nannofor), based on skeletal structure, lifestyle, light and available nutrient, were defined for the Asmari Formation.

The main components in MF1 comprise planktonic foraminifera and fragments of Mollusca shells. The abundance of planktonic foraminifera and absence of photosymbiont bearing taxa suggests deposition in the aphotic zone of an outer ramp setting that could be interpreted as a nannofor association (Mateu-Vicense *et al*., 2008). The marked occurrence of the large benthic foraminifera along with corallinacean red algae in MF2-MF4 could be interpreted as a foralgal association (Pomar *et al*., 2004; Wilson & Vecsei, 2005), deposited in the oligophotic to mesophotic zones of a middle ramp setting during the Late Chattian times. The main

biogenic components in MF6-MF10 are a foramol association (Lees & Buller, 1972; Mutti & Hallock, 2003), related to the euphothic zone of an inner ramp setting during the Aquitanian to Burdigalian times.

Results

This study led to identification of 23 genera and 20 species of benthic foraminifera in the Asmari Formation in the Kuh-e-Siah anticline (north of Dehdasht). Based on the distribution of foraminifera, 3 assemblage zones are recognized. The Asmari Formation at the study area is Late Chattian – Burdigalian in age. Based on skeletal associations (especially large benthic foraminifera and coralline red algae) the following palaeoecological factors are recognized for deposition of the Asmari Formation in the study area including: water salinity of 34psu to more than 50psu, tropical to subtropical environments; oligotrophic to mesotrophic conditions and grain associations of foramol, foralgal and nannofor.

Keywords: Paleoecology; Biostratigraphy; Benthic foraminifera; Asmari Formation.

Refrences

Allahkarampour Dill, M., Seyrafian, A., & Vaziri-Moghaddam, H., 2012. Palaeoecology of the Oligocene-Miocene Asmari Formation in the Dill Anticline, Zagros Basin, Iran. *Neues Jahrbuch für Geologie und Paläontologie – Abhandlungen*, 263: 167-184.

Hallock, P., 2001. Coral reefs, carbonate sedimentation, nutrients, and global change. *In*: Stanley, G.D., (ed.), The history and sedimentology of ancient reef ecosystems. *Kluwer Academic/Plenum Publishers*, New York, pp. 387–427.

Laursen, G.V, Monibi, S., Allan, T.L., Pickard, N.A.H., Hosseiney, A., Vincent, B., Hamon, Y., Van Buchem, F.S.H., Moallemi, A., & Driullion, G., 2009. The Asmari Formation revisited: Changed stratigraphic allocation and new biozonation. *First international petroleum conference & exhibition*, Shiraz, Iran, 4-6: 5.

Lees, A., & Buller, A.T., 1972. Modern temperate-water and warm water shelf carbonate sediments contrasted. *Marine Geology*, 13: 67–73.

Mossadegh, Z.K., Haig, D.W., Allan, T., Adabi, M.H., & Sadeghi, A., 2009. Salinity changes during Late Oligocene to Early Miocene Asmari Formation deposition, Zagros Mountains, Iran. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 272: 17-36.

Mateu-Vicens, G., Hallock, P., & Brandano, M., 2008. A depositional model and palaeoecological reconstruction of the Lower Tortorian distally steepend ramp of Menorca. *Palaios*, 23: 465- 481.

Mutti, M., & Hallok, P., 2003. Carbonate system along nutrient and temperature gradient: Some sedimentological and geochemical constraits. *International Journal of Earth-Science*, 92: 465-475.

Pomar, L., 2001. Types of carbonate platforms: a genetic approach. *Basin Research*, 13: 313-334.

Pomar, L., Brandano M., & Westphal, H., 2004. Environmental influencing skeletal grain sediment associations: a critical review of Miocence examples from the western Mediterranean. *Sedimentology*, 51: 627-651.

Rahmani, A., Vaziri-Moghaddam, H., Taheri, A., & Ghabeishavi, A., 2009. A model for the palaeoenvironmetal distribution of larger foraminifera of Oligocene-Miocene carbonate rocks at Khaviz Anticline, Zagros Basin, SW Iran. *Historical Biology*, 21: 215-227.

Romero, J., Caus, E., & Rosell, J., 2002. A model for the palaeoenvironmental distribution of larger foraminifera based on late Middle Eocene deposits on the margin of the South Pyrenean basin (NE Spain). *Palaeogeography, Palaeoclimatology, Palaeoecology*, 179: 43-56.

Van Buchem, F.S.P., Allan, T.L., Laursen, G.V., Lotfpour, M., Moallemi, A., Monibi, S., Motiei, H., Pickard, N.A.H., Tahmasbi, A.R., Vedrenne, V., & Vincent, B., 2010. Regional stratigraphic architecture and reservoir types of the Oligo-Miocene deposits in the Dezful Embayment (Asmari and Pabdeh formations) SW Iran. *Geological Society of London, Special Publications*, 329: 219-263.

Vaziri-Moghaddam, H., Seyrafian, A., Taheri A., & Motiei, H., 2010. Oligocene-Miocene ramp system (Asmari Formation) in the NW of the Zagros Basin, Iran: Microfacies, paleoenvironment and depositional sequence. *Revista Mexicana de Ciencias Geológicas*, 27: 56-71.

Wilson, M.E.J., & Vecsei A., 2005. The apparent paradox of abundant foramol facies in low latitudes: their environmental significance and effect on platform development. *Earth-Science Reviews*, 69: 133-168.

Wynd, J., 1965. Biofacies of Iranian oil consortium agreement area. *Iranian Oil Offshore Company* Report, no. 1082, unpublished.