Nannofossils

Jain[1] discusses the age paradox of middle Jurassic sediments of Kuldhar Member of Jaisalmer Formation in Jaisalmer Basin exposed around Masrudi nadi section by utilizing the basic Mesozoic age chronometers, i.e. ammonites. He also discusses about its superiority over other micro-fossil groups, viz. calcareous nannofossils and benthic forams.

Nannofossils provide another potentially reliable tool for dating and correlation rather than contest for the supremacy of one fossil group over the other. The calcareous nannofossils are comparatively recently applied for biozonation of marine Mesozoic sedimentary sequences the world over and middle Jurassic nannofossil data are generated from 'mixed' Tethyan province[2,3]. Needless to mention that ammonites have been used for over a century in western Indian basins, both in Kachchh and Rajasthan, for dating purposes. However, global correlation is often restricted due to severe provincialism[4]. Majority of middle Jurassic nannofossils on the other hand are cosmopolitan and useful for long-distance correlation. The rarity or moderate preservation of nannofossils does not hamper their precise identification and usage as biostratigraphic markers. Their minute size helps in escaping mechanical breaking during collection and preparation unlike ammonites and in resolving stratigraphic boundary problems even at centimetre/millimetre scale.

The Kuldhar section representing the type section of Kuldhar Member overlying the Bara Bagh Member is classified under the uppermost part of the Jaisalmer Formation and its age is a point of probe and discussed herein employing ammonites and nannofossils. The article by Jain[1] contains compiled data and comparison of the lithologs of various workers excepting ours[2] (his figure 2) and has shown the various lithounits exposed in Kuldhar nala section. The Kuldhar section contains a distinct unit at its base with several hardground horizons, followed by a shale succession (as shown in figure 2 of our paper[2] and also D in figure 2 of Jain[1]). The samples collected and investigated for calcareous nannofossil studies are from calcareous shales[2] overlying the three ammonite-bearing hardgrounds, as is clearly evident from our litholog reproduced herein. A careful scrutiny of the litholog would reveal that the nannofossil productive horizon overlies the hardgrounds bearing oolitic limestone and calcareous sandstone. The assemblage comprising 21 species is a fairly good representation of middle Jurassic nannofossil species with several zonal/secondary zonal marker nannotaxa.

The probability/liability of reworking and contamination of fossils in condensed horizon is a problem pertaining to all the fossil groups, and nannofossils are no exception. However, nannofossil workers have enough expertise to recognize and evaluate any such occurrences. The shale sequence in Kuldhar section is generally lacking in ammonites. There are no two opinions that the ammonites are the best datable markers in marine Jurassic sequences. However, in the Kuldhar section they are restricted to few bands and not recorded continuously. There seems to be no consensus among ammonite workers themselves about the age interpretations and the taxa encountered from Kuldhar and coeval Kachchh sequences and the index forms used[5].

We would like to emphasize that whichever nannofossil zonal scheme is followed including the one presented by Jain[1] (tables 1 and 2), the age derivation of the shale sequence overlying the oolitic limestone with thin, hard bands shall remain as early Callovian. Our age interpretations[2] (figure 4) are based on a combination of FADs (*A. helvetica*, *S. bigotii bigotii*, *W. manivitae*, *C. perforata*) and LADs (*S. speciosum speciosum*, *S. speciosum octum*, *S. hexum*) and not on isolated species range. All these nannofossil species are zonal indices or secondary zonal markers of various nannofossil zonal schemes[6]. No substantial criterion is produced by Jain[1] to condemn the zonation scheme[6] as old and outdated while advocating the use of a synthesis of nannofossil events presented for future nannofossil work[7]. In the article by Jain, age of shale beds above the hardground is shown as Callovian, which is derived from the study of nannofossils in our paper. There is no contradiction. The problem is of Bathonian–Callovian boundary, which ammonoid data[1] indicate to be in the hardground horizons of the Kuldhar Member. We do not have coccolith data from these horizons so far. We have speculated that this boundary could be below the Kuldhar Member.

A careful comparison of our litholog with those presented by Jain[1] (figure 2) was required for better comprehension of nannofossil datums. We hope that the biozonation based on ammonite be tagged with nannofossil biozonation in tandem as these organisms were living together in Jurassic oceans and integrated mixed Tethyan province data will be useful for world-wide correlation. Also, there exists no age paradox between the two fossil groups.

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