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REVISITING THE PROPOSED AMMONITE ZONATION OF JURASSIC ROCKS OF GANGTA BET, WAGAD, EASTERN KACHCHH

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ABSTRACT

The newly proposed biozones by Patel *et al.* (2012) have been based on the so-called characteristic index species, which have been identified incorrectly. The zonation should remain suspended till finding the true index fossils.

Keywords: Ammonite zonation, Jurarsi rocks, Gangta Bet, Eastern Kachchh

INTRODUCTION

Patel *et al.* (2012) have studied 103+m thick exposed sequence of marine clastic and non-clastic rocks of "Upper Middle Jurassic period" of the Gangta Bet, an uninhabited, unproductive rugged rocky terrain having ruins of a fort, and a small temple of *Ravechi Mata* (the local deity) occupying the highest point of the bet. It is a structurally controlled elliptical dome, an 'island' (=bet in local parlance) surrounded by saline marsh of the Great Rann during most part of an year, situated between the island-belt and the Wagad Highland (to the east of the Kachchh Mainland) in the Great Rann (Patel *et al.*, 2012, p. 130, Fig.1). In my personal experience the area is approachable over land only during the summer months when the Rann swamp dries up. The field conditions are indeed very demanding physically and the authors deserve appreciation for enduring the hardship in order to present before the readership the ammonite occurrences there, confined to the "top part" of the sequence.

The authors have collected some ammonites mainly from the said top part of the sequence in the Gangta Bet, and on their basis, have proposed a biozonation, which they purportedly deem more tenable than by earlier workers. However, no diagnostic features (justifying the validity of their specific identity) have been given for any of these, affecting the validity of their identifications and, therefore, the authenticity of the proposed zonation. The purpose of this report is to highlight the incongruities in the presentation of facts, and the inanity of interpretations.

GEOLOGICAL SETTING

The geological setting of the rocks of Gangta Bet is different from that of the Mainland, and Island Belts: the master (strike) faults graze the E-W elongated dome-like exposures (upthrown blocks) along north, and due to drag-effect, the northern limbs exhibit steeper northern, and gentler southern dips. In the Gangta Bet the situation is just the opposite, i.e. the sothern limbs of the fold are steeper but the northern limbs are gentler. This is because of the Rann/Banni graben-structure between the Gangta Bet and the southern Mainland (upland). While in many Mainland/Island "domes", basic igneous plugs are seen at their respective cores, no such a plug is seen in the Gangta Bet: it may be presumed that a similar phenomenon is responsible for development of a domal flexture here but the ostentious basic igneous core(!) is not exhumed.

Gangta Bet has been considered to be a westerly extension of the Wagad Highland for its proximity, but facies-wise it may equally be qualified as a southern extension of the Khadir formations. The structural features controlling the sedimentation in different parts of the Kachchh Basin must be kept in mind while attempting a physical 'correlation'; the biological one may be a more confusion-free factor in this exercise.

SEQUENCE AND FAUNAL DISTRIBUTION

Although Patel *et al.* (2012, p. 133) have surmised a thickness of "+103 m" comprising a "fining upwards" sequence of clastic sediments "capped" by a fossiliferous ammonite rich limestone – shale development, no precise succession has been presented. Even their lithocolumn (Fig. 2, p. 132: without a proper scale?) presents a different storey! In my brief sojourn to the bet, the sequence (>300m) was found to be comprising several cycles of transgressive and regressive repetitions of varying magnitude. The fossil content, with respect to the contemporary horizons of the Mainland, is sparser, but with little patient searching, one may find examples of macrocephalitins, *Grossouvria*, *Choffatia,* etc. Thus, it is apparent that the exposed sediments here represent Lower Callovian levels, too, below (and not ceasing at M. Callovian!), if not Bathonian. No 'Golden Oolite' has been encountered, which, however, is merely indicative of a certain facies, and is not a time-sensitive phenomenon (Rajnath, 1932).

What is a distinct variation observed by me in the general pattern of clastic sedimentation below, is the top 2+ m thick dirty yellowish/grayish, oolitic marls (not 'limestone'!) with shaly intercalations, apparently dipping towards south and abutting against the Rann-dark saline muds (and mostly covered by thorny acacia shrubs), yielding few fragmentary mayaitins (*Dhosaites/ Paryphoceras*) and a plethora of large "*Astarte major"* J. de C. Sowerby , rechristened *Seebachia (Eoseebachia) sowerbyana* (Holdhaus, 1913) by Fürsich *et al.* (2000). The junction between this oolitic marly bed and the preceding clastic pile is obscured by thick thorny acacia bushes and cacti in the southern span of the 'bet'.

MATERIAL

Patel *et al.* (2012, p. 130) have reported seven (*sic*: eight!) "species" of ammonites, namely "*Mayaites (mayaites) maya, Mayaites* sp. *Perisphinctes Arisphinctes helenae, Perisphinctes*

kranaosphinctes kranaus Perisphinctes Dichotomosphinctes, Perisphinctes sp., *Peltoceras athleta,* and *Peltoceratoides semirugosum*", which have been figured too (2012, Pl. I, figs. 1-8). Of these eight forms, only five have received a specific assignment, which have been deemed as the *characteristic* elements of their three "zones" and five "subzones"!

The authors have also listed one more taxon: "*P. (Dichotomosphinctes)* aff. *Virgulatum"* but let it remain unfigured (2012, p. 132), and so its sanctity cannot be evaluated.

The present ammonite fauna has been mentioned as "abundant" (Patel *et al.*, 2012, p. 129: ABSTRACT) but the collected material cannot be proclaimed so neither in diversity nor in numbers.

The preservation of the figured specimens (2012, Pl. I) is not satisfactory. Four of these are fragmentary (figs. 2, 6-8), three are variously worn (figs. 1, 4, 6), and most (figs. 2, 3, 5-7) are more or less covered by the adhering matrix. Want of adequate number of well preserved specimens deprives the readers from assessing, and appreciating, the diagnosis of the figured ones.

All serious students of ammonites know that these are often homeomorphous and their inter-specific relationship can be better understood by studying their ontogeny. No such endeavour is possible with such an inadequate collection.

The repository of the above listed nine forms (of which eight have been figured), each represented by a single specimen only, has not been stated. None of these bear a registration number either: a gross violation of palaeontological practices necessitated by the ICZN-circumscriptions!

TAXONOMIC APPROACH

The nomenclatorial treatment by the authors *(Patel et al.,* 2012*,* pp. 130*,* 132*)* of their ammonite-finds amply display their disregard towards following the procedures of palaeontological methods of naming, e.g. (i) a biological name of subgeneric rank should start with a capital letter: violated in case of *Mayaites (mayaites) maya*, *Perisphinctes (kranaosphinctes) kranaus*; (ii) all biological names of subgeneric rank must be put within parentheses after the generic one: violated in cases of *Perisphinctes Arisphinctes helenae,* and *Perisphinctes Dichotomosphinctes*; (iii) a 'specific' name should have a trivial one after the higher order names: violated in case of *Perisphinctes (Dichotomosphinctes);* the latter name, thus, cannot be sanctified as a 'specific' one; (iv) a trivial name is customarily written in a lower case but in case of *P. (Dichotomosphinctes)* aff. *Virgulatum*, the norm has not been followed; (v) the gender of the trivial name in *Peltoceratoides semirugosum* (Patel *et al.*, 2012, pp. 129, 130, and 131) is not in consonance with that of the generic one: it ought to have been *semirugosus* which, however, has been rightly mentioned elsewhere (p. 130); (vi) *Kranaosphinctes* has been wrongly spelt as *kranosphinctes* (pp. 129, 130, 131, and 132), and *Karanosphinctes)* which are non-existent as biological names! In the ensuing discussion this wrongly spelt biological entity would be addressed by its legitimate name, i.e. *Kranaosphinctes.*

The authors have, thus, apparently displayed only their disregard/ignorance of the rules of biological nomenclature.

AMMONITE BIOZONATION

Patel *et al.* (2012, p. 130) have suggested three basic "assemblage" zones, namely the (1) Athleta Zone, (2) Maya Zone, and (3) Helenae Zone, in ascending order; the latter two have been subdivided ascendingly into the (i) Semirugosus and (ii) Maya subzones, and (i) Helenae and (ii) Kranaus subzones, respectively. Each of these zones and subzones has been shown to represent specific levels (fig. 2, p. 132) in Gangta Bet. Since all these zones are claimed to be "assemblage" zones, it was expected of the authors to provide with a fuller account of relative abundance of all the respective faunae, highlighting the 'assemblage'. For all these yawning lacunae, the present writer would now like to revisit these zones sequentially in order to examine the validity of each of them.

The Athleta Assemblage Zone

Waagen (1873-75), and Spath (1928-33), had envisaged the presence of an Athleta-level on the basis of other peltoceratins, and their overall biotic assemblage in Kachchh. For his enviable knowledge of global Jurassic ammonites, Spath (1933) had made a threadbare analysis of the peltoceratins of Kachchh , and deftly surmised the presence of "Athleta Zone*" much* ahead of Krishna (1984) or anybody *else* for that matter*,* although the *index* species (*athleta*) was still unknown. The discovery of *P. (P.) athleta* in Kachchh by Prasad and Kanjilal (1985) has sanctified the discernment of Waagen, and Spath.

Although Patel *et al.* vouch for a 'frequent' (2012, p. 130) occurrence of *P. (P.) athleta,* they have obligingly presented only a poorly preserved worn-out example of an ammonite they claim to be a *Peltoceras*; for want of an ascertainment of the nature of ventro-lateral spines, and the venter, it may turn out to be even a *Euaspidoceras*! Moreover, as explained and demonstrated by Spath (1933), there are more than one peltoceratins straddling closely with *P. (P.) athleta ,* but not exactly from the same level. Therefore, the present authors' lone specimen cannot be passed as an undoubted example of *athleta,* and consequently the recognition of an "Athleta Zone" in the Gangta Bet should remain deferred till finding well preserved typical examples of the index species.

The Maya Assemblage Zone

After briefly reviewing the appearance of the mayaitins *vis-à-vis* macrocephalitins, reineckeins, etc. (in Kachchh), the authors (Patel *et al.,* 2012, p. 130) have commented that the characteristic elements ("genera/subgenera" - not species!) of this zone (proposed for the Gangta Bet) are " *Mayaites (mayaites) maya, Mayaites* sp., and *Peltoceratoides semirugosum*". The lower part of this zone has been designated as the Semirugosus Subzone, characterized by "*Peltoceratoides (Peltoceratoides) semirugosus*, with rare *Mayaites".* This subzone is overlain by Maya Subzone, enriched in *"Mayaites (mayaites) maya* which goes up to the Kranaus Subzone with much reduced frequency" (Patel *et al.*, 2012, p. 132). The authors have not mentioned in which of the two subzones occur the form *Mayaites* sp., although they do acknowledge presence of "*Mayaites"* in the Semirugosus Assemblage!

The authors (Patel *et al.*, 2012, p. 132) have goofed up the very validity of their Maya Assemblage Zone by declaring that *M.(m) maya* "makes its appearance at the top of the Semirugosus Subzone". Further, they have stated that *maya* "goes upto the Kranaus Subzone though with much reduced frequency! The plausible fallout of this observation should have been an annulment of the Helenae Assemblage Zone on the one hand, and a redefinition of the Maya Assemblage Zone including the Maya, Helenae and Kranaus subzones. Alternatively, the "Maya Assemblage Zone" of the authors is apparently more apt to be recognised as a 'Mayaites Range Zone', and their "Maya Subzone" is *de facto* a 'Maya Acme Zone'.

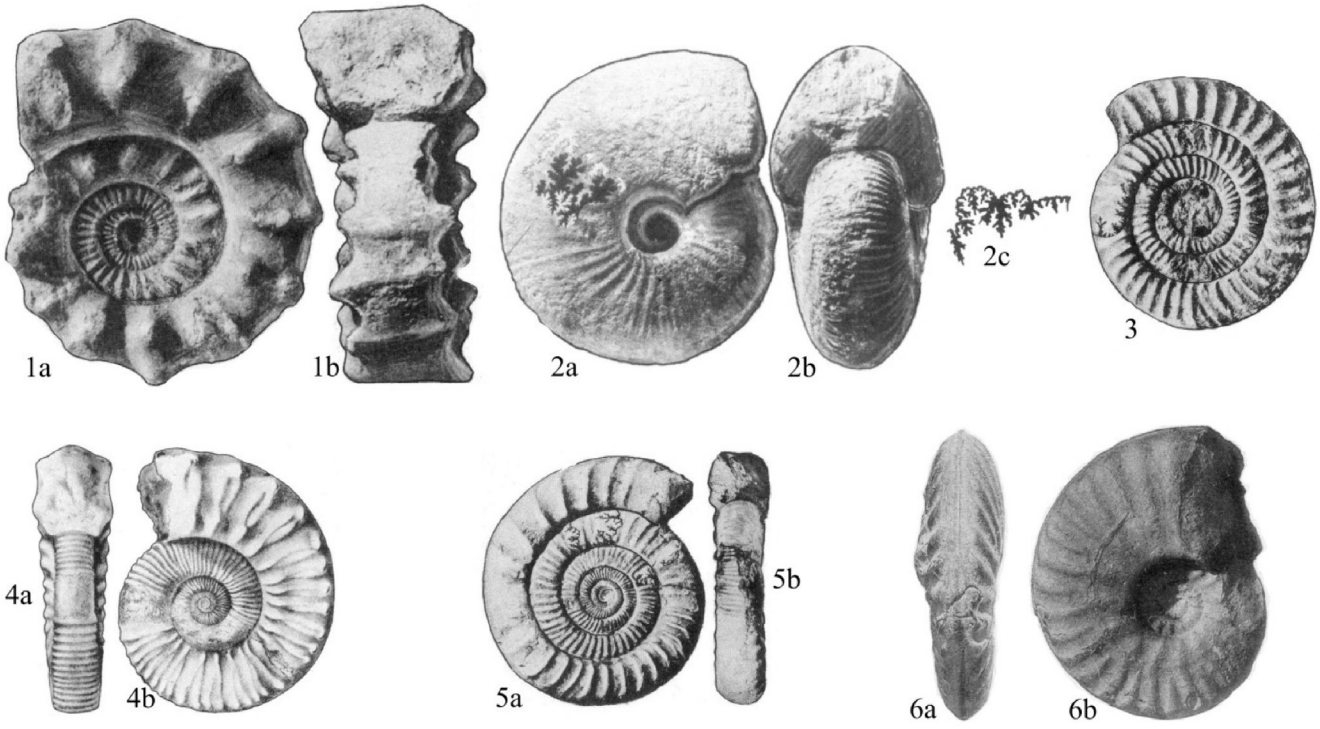

Fig. 1. The following is a list of genera/subgenera and their type species (1-5) as recorded in the of *Treatise Invertebrate Paleontology* (Ed.: Moore, *et al.*, 1957), being reproduced (magnifications may vary here for comparison with the taxa listed by Patel *et al.*, 2012 . The concerned figures and page nos. of the Treatise have been placed within [ ]-parantheses.
1. ***Peltoceras (Peltoceras) athleta*** (Phillips): Lateral (a), and apertural (b) views [Fig.442.7, pp. L335, L337].
2. ***Mayaites (Mayaites) maya*** (J. de C. Sowerby): Lateral (a), and apertural (b) views [Fig. 359.1, p. L298].
3. ***Perisphinctes (Kranaosphinctes) kranaus*** (Buckman): Lateral view [Fig. 409.1, p. L321].
4. ***Peltoceratoides (Peltoceratoides) semirugosus*** (Waagen): Apertural (a), and lateral (b) views [Fig. 441.1, p. L336].
5. ***Perisphinctes (Arisphinctes) cotovui*** Simion: Lateral (a), and apertural (b) views
Fig. 408.1, pp. L320, L321]: reproduced for a subgeneric comparison. The Fig. 6, below, is from Spath (1928, pl. 11 , figs. 9 a, b), and has been included here for comparison with Patel *et al*'s *Perisphinctes* sp. (2012, Pl. I, Fig. 3).
6. ***Hecticoceras (Putealiceras) intermedium*** Spath**.**

Now let us look into the validity of the index species of the authors' two subzones.

The Semirugosus Subzone: The only example of *P. (P.) semirugosus,* figured by the authors (Patel *et al.*, 2012, Pl. I, fig. 4), is a worn-out specimen set in a granular matrix (oolitic or sandy?). The figure provides an oblique view of the lateral side only resulting into a visual distortion, for which the interrelationship of the dimensional proportions cannot be ascertained with conviction. The ventral aspect is unknown, and the ornamentation appears to be rursiradiate, like in *Parawedekindia* Schindewolf. It is, thus, premature to acknowledge this specimen as an example of *P. (P.) semirugosus*.

The Maya Subzone: *M. (M.) maya,* the type species of *Mayaites* s.s. Spath, 1924, is a well know species in the Kachchh Mainland, characterized by giant size; markedly involute, and depressed (T>H) whorls at all the growth-stages; rectiradiate, thick ribs splitting into two or more secondaries passing straight across the rounded periphery.

In the light of these properties, the example of *M. (m.) maya,* figured by the authors (Patel *et al.,* 2012, Pl. I, fig. 5), is obviously a misidentification. The figured example is covered by a granular matrix, and there is no clue whether it is involute. Besides, the apertural view (Pl. I, fig. 5b), does not appear to be depressed, and the ribbing is (probably) comprising single ribs only. This specimen cannot be passed for any species of *Mayaites*!

"*Mayaites* sp." (Patel *et al.,* 2012, Pl. I, fig. 6), *prima facie* an evolute form, can not be deemed even a *Mayaites*! The ornamentation, and whorl-section are unlike any known *Mayaites* s.s.. The specimen, however, bears some resemblance to *Paryphoceras* Spath, 1928 (M. Oxfordian)/*Subkossmatia* Spath, 1924 (from Anceps Zone: M. Callovian), which are homeomorphous. The latter possibility may arise only if the collection is either not *in situ* or 'mixed up' with other specimens belonging to a different level, and thus, losing its stratigraphic value!

The Helenae Assemblage Zone

This is the youngest biostratigraphic unit of the authors from the Gangta Bet occurring "over" the Maya Subzone, and comprises "3-5 m thick part of brown oolitic algal limestone". It would have been interesting, had there been an attempt to compare this oolitic bed with the 'Dhosa Oolite Member' of the Mainland. Beside, the readers might have been educated well by demonstrating how the association of algae with oolites (two diverse entities usually formed under starkly different energy regimes) took place in this part of the Kachchh Basin!

This assemblage zone has been subdivided by the authors into a lower Helenae, and an upper Kranaus subzones. The

former is characterized by *Perisphinctes (Arisphinctes) helenae* Spath, 1931 (*not* 1933!), and is associated with "*P. (Dichotomosphinctes)* aff. *Virgulatum"* (not figured!), while the latter yields *P. (Karanaosphinctes, sic.) kranaus* associated with "other species of *Perisphinctes"*(?). It may be noted that no *Mayaites* has been recorded in the biotic assemblage of both these subzones, although a little earlier (cf. Maya Subzone), *maya* has been deemed to go " upto the Kranaus Subzone with much reduced frequency" (Patel *et al.,* 2012, p. 132).

The Helenae Subzone: The figured specimen of *Perisphinctes (Arisphinctes) helenae* is merely a markedly compressed fragment (? Phragmocone) exhibiting flat and parallel sided flanks sporting straight**,** prorsiradiate ribs. The available fragment does not show any constriction, a property found in all *Arisphinctes*. With so little inconsequential features, even its subgeneric status cannot be ascertained and, therefore, acknowledging this fragmentary specimen as a ' *helenae'* cannot be sanctified.

The lone specimen of *Perisphinctes* sp., claimed to belong to the Helenae Zone (Subzone?), too, has been misidentified! The genus is characterized by sharp, usually bifurcating ribs on the flanks, along with few constrictions per whorl (evolute), interrupting the ribbing. None of these features are present in the figured specimen, which, thus, cannot be a *Perisphinctes*! This specimen morphologically matches well with compressed *Putealiceras* Buckman, 1922 (a subgenus of *Hecticoceras* Bonarelli, 1893, and particularly with *H.* (*P.*) *intermedium* Spath, 1928, which comes from Late Callovian levels in *Kachchh*. If so, the present find becomes an object of *'collection failure'!*

The Kranaus Subzone: The figured example (Pl. I, fig. 7) of *"Perisphinctes (kranosphinctes) kranaus"* is yet another fragmentary specimen (? phragmocone) with rounded whorl section, and flank bearing sharp, prorsiradiate ribs, each bifurcating at a point much above the middle of the whorl height. No constriction is seen, again a generic/subgeneric requirement! This lone specimen, too, cannot be regarded as *kranaus.*

The proposed Helenae Assemblage Zone too is, thus, invalid.

This biozonation (of Patel *et al.*, 2012) has been ignored altogether by Pandey *et al.*, 2013!

DISCUSSION

No succession of beds of the Gangta Bet has been provided. True thicknesses of the fossiliferous beds too are not given. The reader cannot guess whether the fossils are uniformly dispersed in the bed or are found confined in one or more respective levels. The collected specimens are either poorly preserved (some still covered by matrix) or fragmentary. Their taxonomic identities are far from exactness, rather imaginary. Therefore, the biozones, proposed on their basis, have no basis at all! The whole presentation is, thus, not acceptable till finding well preserved examples exhibiting diagnostic features.

The authors have denounced the post-Spath (1927-33) works on correlation "between" the Mesozoic sediments of the "Mainland Kachchh, Island belt and the Wagad region" as untenable! On the one hand, their arrival at such a conclusion has not been explained, while on the other, they have acknowledged such Mainland period-works (Krishna, 1984; Prasad, 1998), based and imitate slavishly, in their proposed "correlation" (Patel *et al.*, 2012, p. 133, and Table 1, p. 133 respectively). It has to be borne in mind that in a single basin, similar type of ammonites would normally occur at a given time, subject to palaeobathymetry and palaeosalinity: claiming a *first time proposal* is, thus, a vanity.

CONCLUSIONS

1. Patel *et al.* (2012) have studied only 103+ m of sediments in the Gangta Bet, but the total thickness of all the beds is considerably much more.
2. Sequence of 'beds' with their detailed lithology is wanting.
3. The bulk of the ammonites reportedly come from the upper 12 m thick rocks of Late Callovian to Middle Oxfordian age, while Early and Middle Callovian ammonites too, are, indeed present in older strata.
4. The authors have listed eight taxa (not seven "species") of which three are not identified specifically. Besides one more, namely "*Perisphinctes (Dichotomosphinctes)* aff. *Virgulatum"* has neither been included in the list of collection, nor figured!
5. Neither the repository of the studied ammonites nor their registration numbers have been given, which is a gross violation of palaeontological norms and practices.
6. The authors have amply exhibited their disregard for nomenclatorial procedures necessitated by the ICZN. But for the *Peltoceras (Peltoceras) athleta* (Phillips), the authors of the various specific names have not been mentioned.
7. No attention has been paid in aligning the gender of the trivial name with respect to that of its genus, another lapse (*lapsus calami* ?) pertaining to nomenclatures.
8. Three zones and five subzones have been proposed for the Gangta Bet ammonite biota nonchalantly, *vis-à-vis* the authors' post-Spath (1927-1933) works. Yet their "ammonite zones, and their correlation" is merely an imitation of Prasad's (1998) biozonation, proposed for a part of the Kachchh Mainland.
9. The entity of the zones proposed by the authors is paradoxical, because of incorrect identification of their "characteristic species".
10. Stratigraphic usages, e.g. "Early Late Callovian" (Patel *et al*, 2012, p. 133: Conclusion) are not in accordance with the 'Codes of Stratigraphic Nomenclature': it should have been early Late Callovian! In addition, usages like *Helenae* zone, are grossly incorrect: according to the 'Code' it should have been Helenae Zone!
11. There is discrepancy in the text (Conclusion) and the Table 1 (both on p. 133) pertaining to the age of the "*Helenae* zone".
12. A formally proposed biozone should commence with an upper case letter; thus Athleta zone, etc. (cf. p.133: Conclusion-2) should have been mentioned as Athleta Zone, etc.
13. The reason for recognizing only an Athleta Subzone (vide Table 1, p. 133) in the Athleta Zone, in the Gangta Bet has not been explained: what intervenes between the authors' "Athleta" and "Semirugosus" subzones should be conveyed to the readers, because of obvious geological repercussions.
14. The ages of some zones/subzones in the Gangta Bet rocks (Patel *et al.*, 2012) are in contradiction, e.g.:
    (i) In the Abstract (p. 129), the age of the rocks have been said to range from "Late Callovian to Early Middle Oxfordian", while in Fig. 2 (p. 132) the sequence has been regarded of Middle Callovian to Middle Oxfordian age, and in Table 1 (p. 133) it is from early Late Callovian to late Middle Oxfordian!

(ii) The Maya Assemblage Zone spans from "Early to Middle Oxfordian" (p. 130), while the Table 1 shows it to range from Late Oxfordian to early Middle Oxfordian!

(iii) The Maya Subzone has been considered of "Middle" Oxfordian times (p. 132), but in Fig. 2 (p. 132) it is put at an "Early" Oxfordian level, while in Tabl 1 at "Early" Middle Oxfordian"!

(iv) The Helenae Assemblage Zone has been assigned a "late" Middle Oxfordian age (p. 132), but in Fig. 2 it is "M. Oxfordian", and in Table 1 the level has been confined at "middle-late" Middle Oxfordian: the Helenae Subzone indicating a "middle" Middle Oxfordian, and the Kranaus Subzone a "late" Middle Oxfordian level!

With so much morass, and so many pot-holes of untenable façades around, the readers are advised to tread the Gangta Bet alleys with caution!

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