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THE EQUIVALENT OF THE "FARAONI LEVEL" (UPPERMOST HAUTERIVIAN, LOWER CRETACEOUS) RECORDED IN THE EASTERN PART OF TRENTO PLATEAU (VENETIAN SOUTHERN ALPS, ITALY)

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Riassunto. Nei pressi di Feltre (Alpi Meridionali, Veneto), negli affioramenti di Cismon e Pian del Vescovo, è stato riconosciuto nella formazione del Biancone un equivalente del Livello Faraoni, originariamente descritto come Livello repere regionale nell'Appennino Umbro-Marchigiano. In particolare, lo strato contenente una ricca fauna ad Ammoniti della sottozona a *P. catulloi* (Hauteriviano terminale) ed i sottili "black shales" che nella sezione del Cismon lo precedono sono correlabili con la parte inferiore del Livello Faraoni descritto in Umbria-Marche. Nello strato ad Ammoniti si osserva, come in Appennino, una abbondanza di Foraminiferi planctonici primitivi di tipo globigerinide identificabili come *Gorbachikella* spp. Il rinvenimento su una vasta area della Tetide Mediterranea di analoghi litotipi, ed in particolare di uno strato ricco in Ammoniti con identico tipo di conservazione, deve essere messa in relazione a variazioni paleoceanografiche che interessarono lo zooplankton e le Ammoniti.

Abstract. An equivalent of the Faraoni Level, originally described in the Umbria-Marche Apennines as a regional lithostratigraphic marker, was recognized near Feltre (Venetian Southern Alps) in the Biancone formation of the Cismon and Pian del Vescovo sections. The ammonite-rich bed of the *P. catulloi* subzone (uppermost Hauterivian) and the underlying thin black shales in the Cismon section are correlatable with the "Lower interval" of the Faraoni Level described in Umbria-Marche. As in the Apennines, in the ammonite-bearing bed a flood of primitive, globigerina-like planktonic foraminifers, identified as *Gorbachikella* spp., was observed. The deposition of similar lithologies, particularly the ammonite-rich bed, over a wide area of the Mediterranean Tethys suggests palaeoceanographic changes affecting the zooplankton and the ammonite communities.

Introduction.

This short note is focused on the documentation of an equivalent of the Faraoni Level within the Biancone formation of the Venetian Southern Alps. In particular, an ammonite-bearing bed was observed at the Cismon and Pian del Vescovo sections. This layer is coeval and very similar to the "Guide bed" of the Faraoni Level, which was originally described as a regional marker by Cecca et al. (1994a) in the Maiolica formation of the Umbria-Marche Apennines. The Biancone formation (of mainly Early Cretaceous age) consists of light grey to grey pelagic nannoconid-limestones, with chert lenses and nodules. A peculiar reddish/pinkish interval was distinguished in a few sections oucropping in the Southern Alps and dated as Hauterivian-Barremian (Bosellini et al., 1978). Bio-magnetostratigraphic studies of several sections allowed the attribution of such an interval to magnetic chron CM4 (Channell et al., 1979, 1993).

The Maiolica formation (Early Cretaceous) in the Umbria-Marche Basin is very similar in lithology to the Biancone formation but a "reddish/pinkish interval" was never observed.

The Faraoni Level was defined in Umbria-Marche as a 25 to 40 cm thick alternance of organic carbon-rich black shales (Baudin et al., 1995) and limestones. One of the limestone beds, named "Guide-bed", is characterized by a well preserved, rich and diverse ammonite fauna indicating the uppermost Hauterivian *P. angulicostata* zone, *P. catulloi* subzone. The Faraoni Level was correlated to the middle part of chron CM4 in two sections of the Umbria-Marche Apennines (Cecca et al., 1994b; Channell et al., 1995).

The field data at Cismon and Pian del Vescovo.

The Cismon section crops out at km 52.6 of the State road n. 50 (Fig. 1), along the valley of the Cismon river. The age control of the Cismon section is based on intergrated litho-bio-magneto-chemostratigraphy (Channell et al., 1979; Bralower, 1987; Weissert et al., 1985; Weissert, 1989; Erba; 1994). Magnetic chron M4 begins

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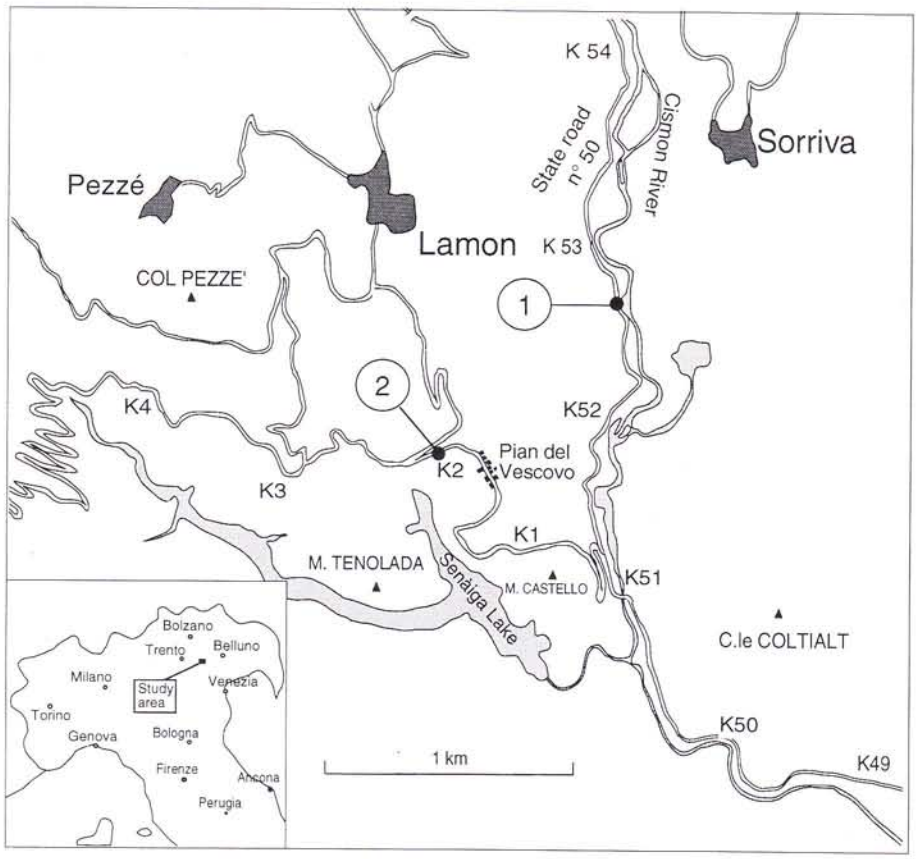

Fig. 1 - Location map. 1: Cismon section; 2: Pian del Vescovo section.

in the uppermost part of the "red interval" and is 2 m thick. The surveyed portion of the section starts at the top of the "red interval" followed by 60 cm of grey limestone and by the following lithologic succession, from bottom to top (Fig. 2):

1) black shale; 0.5 to 1 cm;
2) thin calcareous lenses; 0 to 0.5 cm;
3) black shale; 0 to 0.5 cm;
4) grey limestone, 42 cm-thick, subdivided in two parts by a stylolithe: 4a, rich in ammonites (24 cm); 4b, devoid of ammonites (18 cm);
5) grey-green marly interbed; 0.5 cm;
6) limestone; 4 cm;
7) grey marl; 0.5 cm.

The rich ammonite fauna from layer 4a comprises the following taxa: *Phyllopachyceras infundibulum* (d'Orbigny), *Neolissoceras grasi* (d'Orbigny), *Hypophylloceras tethys* (d'Orbigny), *Pseudothurmannia mortilleti* (Pictet & De Loriol), *P. sarasini* Sarkar (Fig. 3), ?*Emericiceras* cf. *clausum* (Sarasin & Schöndelmayer), *Psilotissotia* n. sp. and *Barremites* sp. The ammonites bear a pseudomorphic test and are filled by micrite and calcite in geopetal structure. Tectonic fractures often break the fossils.

The Pian del Vescovo section is located only 1 km west of the Cismon section along the road to the Lamon town at km 2 (Fig. 1). Here, layer 4 was observed and is splitted into two parts by a stylolithe, being the lower part enriched in ammonites as in the Cismon section. However, only one black-shale layer was identified below layer 4 and seems to correspond to the interval 1-3 from Cismon section (Fig. 2). The ammonite fauna from layer 4 of the Pian del Vescovo section includes the following taxa: *Phyllopachyceras infundibulum* (d'Orbigny), *Pseudothurmannia catulloi* (Parona), *P.* cf. *sarasini* Sarkar, ?*Emericiceras* sp., *Psilotissotia* sp. and *Barremites* sp.

The ammonite fauna from layer 4a at both localities is indicative of the base of the *P. catulloi* subzone of the *P. angulicostata* zone of latest Hauterivian age.Microfacies analysis was carried out on the Cismon section from the top of the "red interval" to sample +2 (Fig. 2). Few types of microfacies were distinguished: (1) largely dominated by micrite with sparse radiolarians and benthic foraminifers in samples -4, -1, and +2; (2) dominated by radiolarians along with sparse benthic foraminifers in samples -3 and in layer 4b; (3) characterized by very abundant primitive, globigerina-like planktonic foraminifers identified as *Gorbachikella* spp. (Fig. 4a-e) and abundant radiolarians in the ammonite-bearing layer 4a; (4) characterized by scattered, small-sized planktonic foraminifers together with very rare radiolarians in sample -2, half a way between the "red interval" and layer 4a. The planktonic foraminiferal assemblage of sample -2 is much more diversified than in layer 4a and includes:

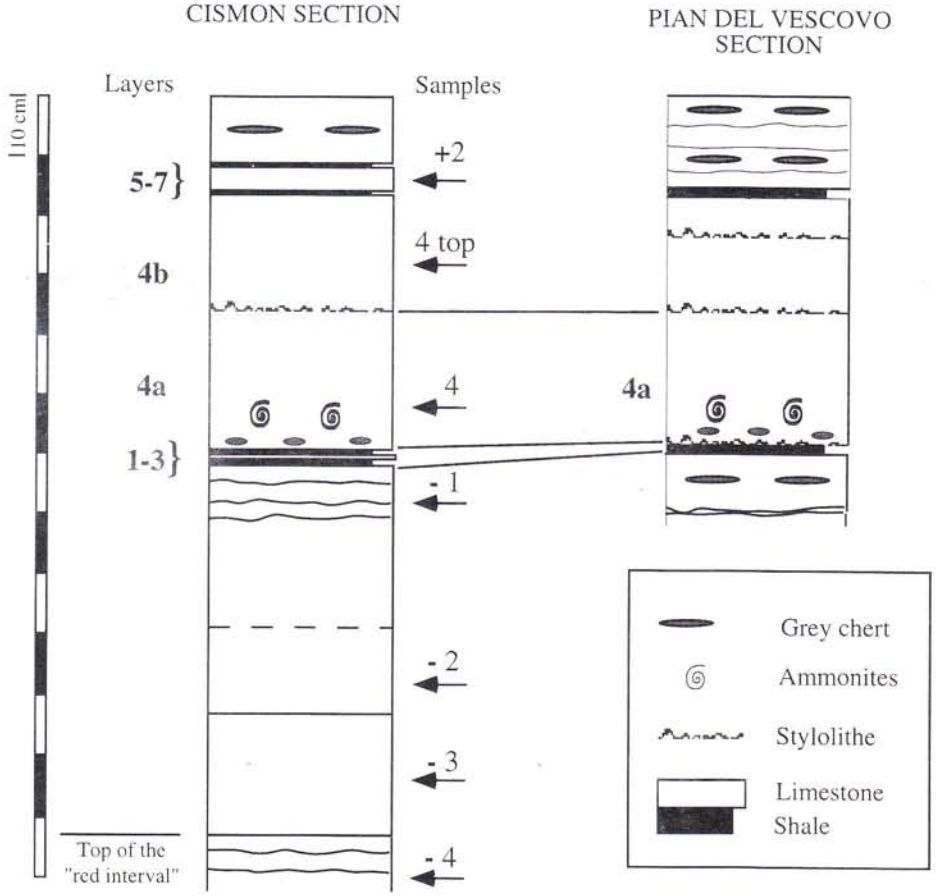

Fig. 2 - The Cismon and Pian del Vescovo sections and position of the samples for micropaleontological study.

Clavihedbergella eocretacea Neagu (Fig. 4h), *Favusella hauterivica* (Subbotina), *Globigerinelloides* ? sp., *Hedbergella aptica* (Agalarova) (Fig. 4f), *H. delrioensis* (Carsey) (Fig. 4g), *H. sigali* Moullade. This association is attributable to the *H. sigali* - *H. delrioensis* Zone spanning the entire Hauterivian (Coccioni & Premoli Silva, 1994). Benthic foraminifers (tentatively identified as ammodiscids, textularids, nodosarids and miliolids) are scattered through the studied interval.

Microfacies analysis was carried out on one sample from layer 4a at Pian del Vescovo. It shows the same microfacies characters than layer 4a at Cismon, in particular the abundance of *Gorbachikella* spp.

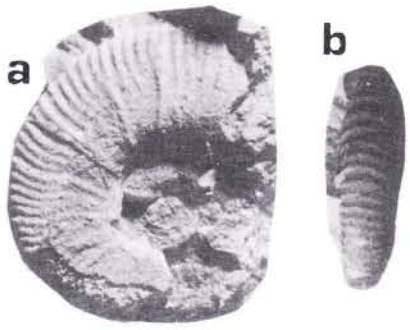

Fig. 3 - *Pseudothurmannia sarasini* Sarkar: a, lateral view; b, ventral view. Cismon section, layer 4a, x1.

Correlations to the Faraoni Level from the Umbria-Marche Basin.

As mentioned above, a similar ammonite fauna indicative of the base of the *P. catulloi* subzone of the *P. angulicostata* zone was previously found with an identical preservation in the "Guide-bed" of the Faraoni Level from the Umbria-Marche Basin (Cecca et al., 1994a). In addition, the "Guide-bed" also yielded the same peculiar flood of primitive, globigerina-like planktonic foraminifers identified as *Gorbachikella* (Coccioni et al., submitted). Thus, although in the Umbria-Marche succession radiolarians are much more abundant overall, it seems that the ammonite-bearing portion of layer 4 from the Cismon area is equivalent of the "Guide-bed" of the Faraoni Level from the Umbria-Marche area.

The succession from northern Italy, however, is hard to correlate bed by bed with that from the Umbria-Marche. Cecca et al. (1994a) described the Faraoni Level as composed by (from bottom to top):

- "Lower Interval", with layers A (black shale), B (limestone), C (black shale);
- "Guide-bed", a 18-20 cm-thick ammonite-rich limestone (layer D);
- "Upper Interval": with layers E (black shale), F (limestone), G (black shale).

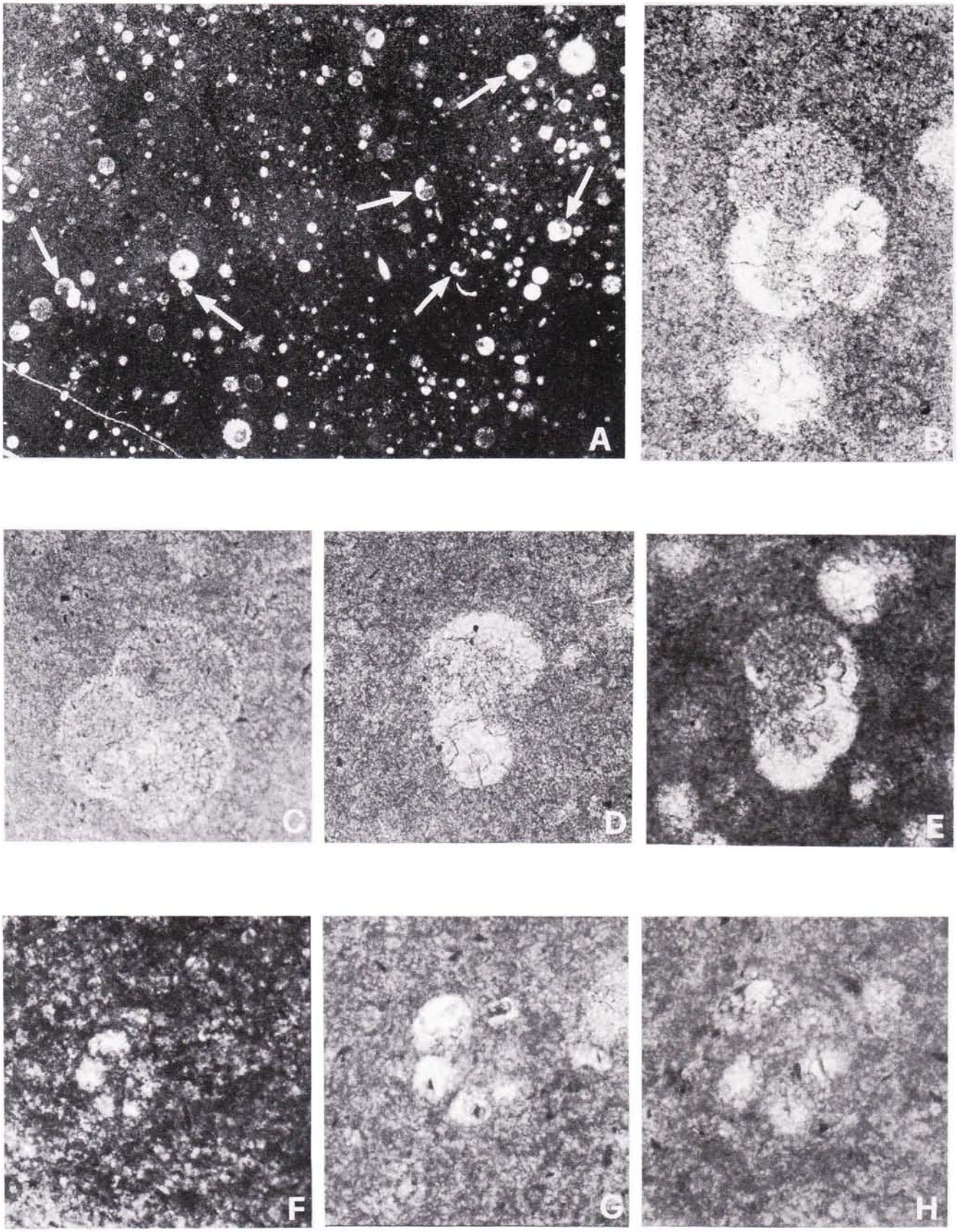

Fig. 4 - A) microphotograph of *Gorbachikella* (arrows) assemblage with radiolarians, x 25; B, C) *Gorbachikella* sp., transverse section, x 160; D, E) axial section, x 160; F) *Hedbergella aptica* (Agalarova), transverse section, x 290; G) *Hedbergella delrioensis* (Carsey), transverse section, x 290; H) *Clavihedbergella eocretacea* Neagu, transverse section, x 290. All microphotographs from Cismon section: A-E, layer 4a; F-H, sample -2 (see Fig. 2).

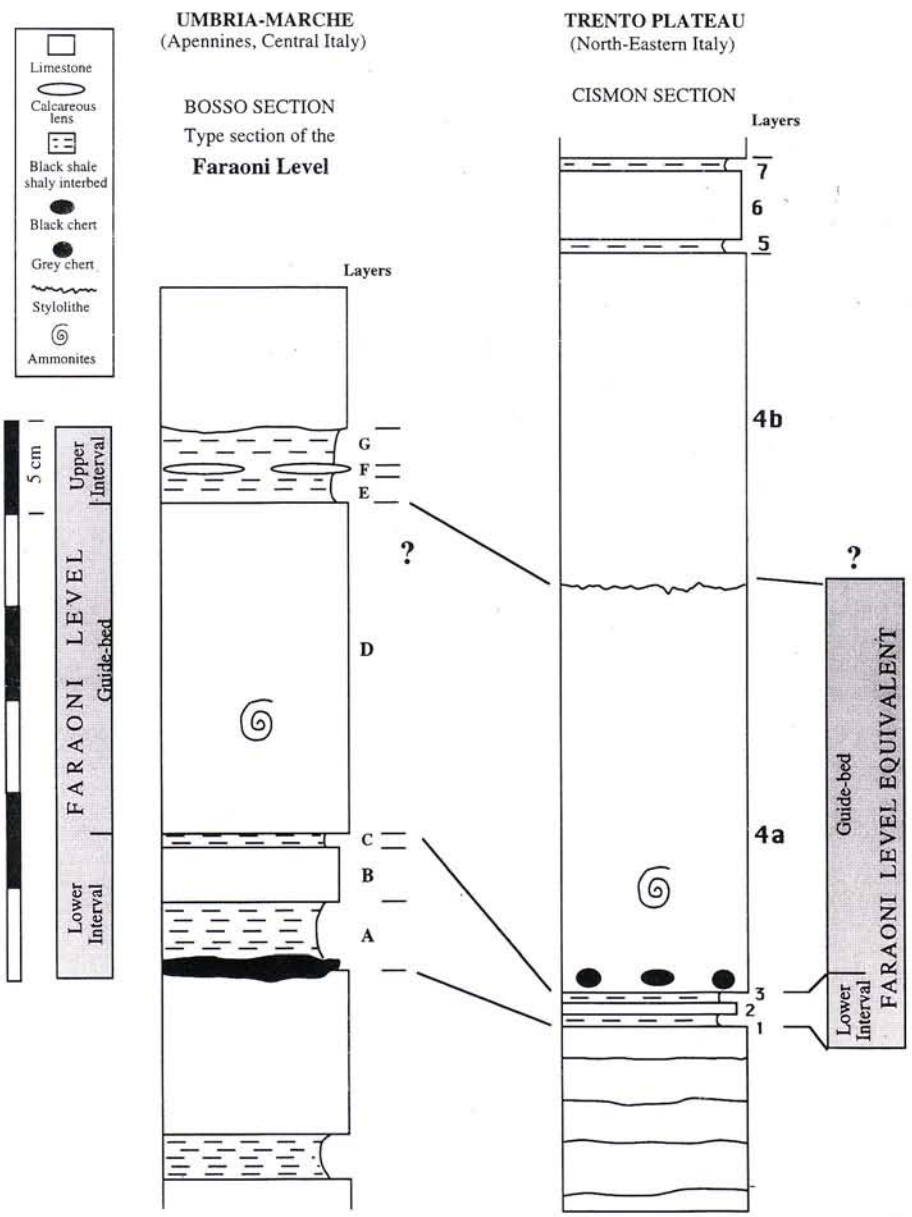

Fig. 5 - Simplified lithologic logs and proposed correlations of the Bosso section, type section of the Faraoni Level (Marche Apennines) and the Cismon section (Trento Plateau).

In Figure 5 we tentatively correlate (1) the "Lower Interval" of the Faraoni Level (Cecca et al., 1994a) with levels 1 to 3 from the Cismon section, although the marcasite nodules and black chert were not observed in both the Cismon and Pian del Vescovo sections; (2) layer 4a from both Cismon and Pian del Vescovo sections is equivalent to the "Guide-bed" of the Faraoni Level in Umbria-Marche; (3) the "Upper Interval" seems to be absent in the Cismon area, being apparently deleted by the stylolithe surface. The latter interpretation is speculative and the suggested correlation is marked by question marks. Definitely, layers 5-7 from the Cismon section are not correlative to the Faraoni's "Upper Interval".

Discussion and Conclusions.

Despite the lithological differences between the Biancone and Maiolica formations, and particularly in the Upper Hauterivian interval, we suggest that the "Guide-bed" of the Faraoni Level is also present in the Cismon area, some 500 km apart in terms of modern geography. This implies that the palaeoenvironmental conditions leading to the deposition of this ammonite-bearing bed acted at much larger scale than previously thought (Cecca et al., 1994a).

It is worth mentioning that Hoedemaeker (1995a) reported an important turnover of ammonite faunas at the base of the *P. catulloi* subzone. Such an event was correlated to a sea-level fall corresponding to a type-1 sequence boundary (Hoedemaeker, 1995b). In Umbria-Marche and Cismon area this faunal turnover is depositionally represented by the "Guide-bed" and layer 4a, respectively.

The abundance of ammonites in the "Guide-bed" might indicate a reduced accumulation rate or a mass-mortality event. The flood of primitive, monogeneric

planktonic foraminiferal assemblage associated to this peculiar layer suggests that a change in surface water structure and trophism may have occurred at the time of its deposition. In fact, planktonic foraminifers below and above the "Guide-bed" in the Maiolica are rare and discontinuously recorded (Micarelli et al., 1977; Coccioni et al., 1992; Cecca et al., 1994b).

The organic matter of the black shales of the "Lower" and "Upper" intervals of the Faraoni Level is mainly of marine origin: type II organic matter and a mixture of type II and III have been distinguished (Baudin et al., 1995). The palynofacies are dominated by amorphous organic matter and dinoflagellate cyst assemblages are scarse and poorly diversified (Baudin et al., in press). The geochemical and palynological data support the hypothesis of dysoxic rather than strictly anoxic conditions on the sea-floor (Galeotti, 1996; Baudin et al., in press) during the deposition of the black-shale layers.

Minor fluctuations of δ13C were recorded in the Upper Hauterivian-Lower Barremian limestones of the Southern Alps (Weissert et al., 1985; Weissert & Lini, 1991; Channell et al., 1993) and might suggest changes in palaeoproductivity.

Our study demonstrates that part of the Faraoni Level occurs in a palaeogeographic area wider than previously thought. The lithological and palaeontological characteristics of the "Guide bed" seems to be related to palaeoenvironmental change as suggested by geochemistry (Baudin et al., 1995; in press) as well as ammonites and foraminifers. We speculate that changes in palaeoproductivity affecting the zooplankton and the ammonite communities resulted in the deposition of the ammonite-rich bed. Further multi- and interdisciplinary studies are needed to clarify the palaeoceanographic conditions and palaeobiologic changes which led to the deposition of the Faraoni Level.

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