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**THE MIDDLE CENOMANIAN *LAGERSTAETTE* OF AL NAMMOURA  
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A particular fossil assemblage of articulated vertebrate skeletons, plants, and shell-lacking invertebrates, characteristic of the fossil *Lagerstätten*, is present in two quarries opened in the al Gabour Valley, near al Nammoura village, about 50 km NNE of Beirut, Lebanon. Fossils are rather rare in the site but extraordinarily well preserved.

The most common fossils are small fishes two to three centimetres long, usually complete but also fragmentary parts were found. The second group as frequency are the terrestrial plants. Among them, a characteristic composite "leaf" with three (less commonly four, rarely five) elongated leaves is decidedly the most common. Leaves probably belonging to the Bennettitales are also relatively common, whereas conifers are very rare. Medium to large fishes are the most diversified animal group of the assemblage but they have never been object of publication, if *Sorbinichthys* Bannikov & Bacchia is excluded. Crustacean decapods appear to be rare. Small coprolites and gastric ejects (millimetric pellets made mainly by thin bones) are present, the second relatively common. Only a slab with an accumulation of *Avicula*-like bivalves and a single, small rudist were found. Reptiles are represented mainly by articulated skeletons of aquatic taxa, among which turtles are prevailing. The dolichosaur *Aphanizocnemus libanensis* Dal Sasso & Pinna comes most probably from this site. A new dolichosaur and a *Pachyrachis*-like ophiomorph are at present under study at the Museo Civico di Storia Naturale of Milano (C. Dal Sasso & S. Renesto, this volume). Articulated phalanges, with a very elongate penultimate phalanx and a relatively short ungual, on exhibit in an antiquities shop of Jbaïl possibly belong to the hand of a large theropod dinosaur. Finally, small, isolated feathers were found too. It is the second record of Mesozoic feathers in the Africa-Arabia continent (feathers were found only in the Albian amber of Southern Lebanon; Schlee, 1973; Chiappe, 1995). Unfortunately, most of the quarried fossils are sparse in private collections all over the world. The largest public collection in Italy is at the Museo Civico di Storia Naturale of Milano.

The fossil association is different from those of the famous Lebanese sites of Hjoula and Haqel (=Hakel), where terrestrial plants are rare, reptiles are unknown and feathers absent. It seems to indicate a higher proximity to emergent areas.

The stratigraphic section is well exposed along the nearly vertical flanks of the valley (Fig. 1). At the base, marly limestones with chert and limestones with planctonic foraminifers and pelagic crinoids are found, indicating basinal conditions (a). A clastic wedge prograding from NE on this basinal interval is observed (Fig. 1; b). The *Lagerstätte* interval (c) onlaps the wedge. It is composed by about 10 m (lower quarry) to 25 m (upper quarry) of gray-blu to greenish, thinly laminated and slaty limestones with small chert nodules. They appear in thin section as very thinly grained mudstones-wackestones-

packstones with a “varved” aspect, with very small intraclasts and without microfossils. Bedding is undisturbed, slumpings and ruditic beds are absent. Absence of planctonic microorganisms and re-sedimentation beds points to an isolation from the open sea and a relatively protected and stable setting. The *Lagerstätte* closes to NE against the wedge and also rapidly to W as showed by its different thickness in the two nearby quarries.

Above the *Lagerstätte* interval, non-laminated limestones with chert concretions, a horizon of marly limestone, an interval of withish limestone with rudist bivalves and a rudstone level with clasts made by rounded fragments of rudist shells follow (d). They indicate a rapid shallowing upward, an increase of environmental energy and “normal” conditions (oxygen, salinity, Ph ect.) of the waters at the bottom. They onlap the bioclastic wedge too. The withish limestone is just some metres above the *Lagerstätte* interval (Fig. 1) and contains *Pseudorhapydionina laurinensis* (De Castro), *Pseudorhapydionina dubia* (De Castro), *Prealveolina* gr. *cretacea* (D’Archiac), *Pseudedomia drorimensis* Reiss, Hamaoui & Ecker, and *Conicorbitolina* gr. *conica* (D’Archiac) which suggest a Middle Cenomanian age. The compressive maximum thickness of this part of the section (laminated limestones [C] included) is less than 50 m (see Fig. 1) and corresponds more or less to the local depth of the basin.

About 30 m of gray-greenish to beige, laminated, marly limestones with chert (e) follows and indicates a drowning of the zone and the return to basinal conditions. Above, more than 150 m with prevailing platform facies (f) indicates a new regression. An interval rich of *Ovalveolina* cf. *ovum* (D’Orbigny) (Fig. 1, asterisk \*), and one with radiolitic rudists and accumulations of oyster-like bivalves (Fig. 1, double asterisks \*\*) are found. The microfossil associations present also *Pseudorhapydionina laurinensis* (De Castro), *Pseudorhapydionina dubia* (De Castro), *Vidalina* spp., *Biplanata peneropliformis* Hamaoui & Saint-Marc, *Pseudolituonella reicheli* Marie and *Chrysalidina gradata* D’Orbigny, which date this part of the section to the Late Cenomanian.

Therefore, the age of the al Nammoura *Lagerstätte* is the upper part of the Middle Cenomanian and is a little younger than that of the Hjoula and the nearby Haqel site, which are reported as Early Cenomanian (Hüchel, 1970; Saint-Marc, 1974).

As consequence, the correct identification of the provenance of the specimens coming from the Cenomanian Lebanese *Lagerstätten* is necessary for evolutionary and paleoecologic analysis. Haqel and Hjoula sites formed into tectonic basins due to transpressive tectonics following Hüchel (1970) or silled basins at the transition outer platform-basin following Saint-Marc (1974). Gravitative flow deposits were common in these basins, unlikely the case of al Nammoura basin which probably had a different origin, related to the migration of the platform margins, probably caused by eustatism.

#### REFERENCES

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Fig. 1 - Panoramic view of the al Gabour valley from above, with the two quarries and the stratigraphic section described in the text. Dotted lines indicates the bottom of the valley.



