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The Gargasian (Middle Aptian) substage in the Aptian historical stratotypes (SE France): General introduction

Michel MOULLADE[1]

Guy TRONCHETTI[2]

Key Words: Stratigraphy; Cretaceous; Aptian; Gargasian; Bedoulian; stratotype; France

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Mots-Clefs : Stratigraphie ; Crétacé ; Aptien ; Gargasien ; Bédoulien ; stratotype ; France

In 1998 a double volume of the Journal "Géologie Méditerranéenne" (t. XXV, Nº 3-4) was devoted to a detailed inventory of the Lower Aptian (Bedoulian substage) historical stratotype located in the vicinity of Cassis and Roquefort-La Bédoule, near Marseille (Bouches-du-Rhône, SE France) (Fig. 1). That revision used the methods of integrated stratigraphy on a closely spaced selection of samples that combined the study of various macro- and microfossils groups with the sedimentological and geochemical (trace-elements and stable isotopes) characteristics of the associated rocks.

The multi-disciplinary team that made this study of the type Bedoulian was compelled to continue it for the medial Aptian (= Gargasian) substage. Because the last detailed work on the type-locality at Gargas, near Apt (Vaucluse, SE France) (Fig. 1) dates back several decades (OERTLI, 1958; ABOUSSOUAN, 1963; MOULLADE, 1965; ROCH, 1971; LONGORIA, 1974; GIROUD D'ARGOUD, 1975; MOULLADE, 1980; see also historical summary in ROPOLO & MOULLADE, 2002), updating was definitely needed.

However, new research on this stratotype is complicated by the quasi-disappearance of the Gargasian historical type-section, namely outcrops on a hill close to the village of Gargas. This kind of outlier is nowadays entirely covered by vegetation and subject to the rapid and

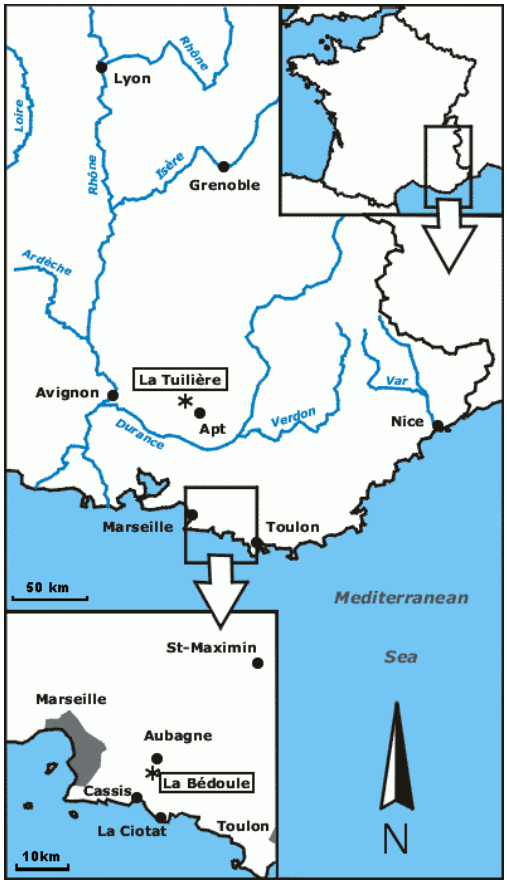

Figure 1: Geographic location of the two Aptian historical stratotypes.

[1] *Centre de Recherches Micropaléontologiques, Museum d'Histoire Naturelle, 60 Bd Risso, 06000 Nice (France); Centre de Sédimentologie-Paléontologie, CNRS UMR 6019, Université de Provence, Centre St Charles, Case 67, Place Victor Hugo, 13331 Marseille Cedex 03 (France)*
Michel.Moullade@unice.fr

[2] *Centre de Sédimentologie-Paléontologie, CNRS UMR 6019, Université de Provence, Centre St Charles, Case 67, Place Victor Hugo, 13331 Marseille Cedex 03 (France)*

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intensive development of the Apt-Gargas conurbation. In the late sixties those outcrops near Gargas were the only place in the Apt area where it was still possible to observe almost all of the Gargasian strata, in particular the almost continuous exposure of their sandy upper terms, there overlain by Albian sandstones which crowned the hill and protected it from further erosion (MOULLADE, 1965).

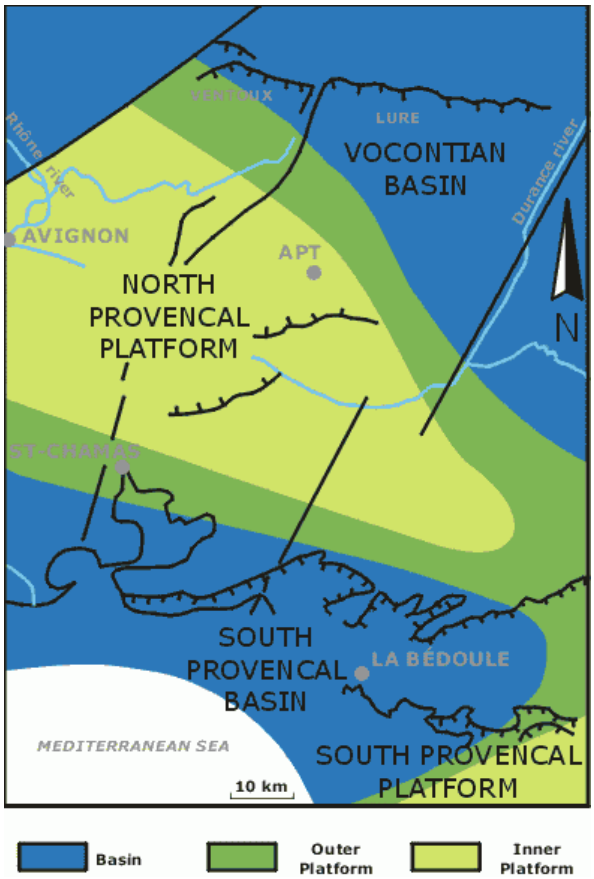

Figure 2: Paleogeographic sketch map of the Lower Aptian in the Provence region.

Guided by the experience of L. BULOT and J.-P. MASSE we selected a replacement section for the lower part of the Gargasian and its relations with the underlying Bedoulian. This section has an even better and more continuous exposure of the lower part of the series than that which once existed at Gargas. It comprises several outcrops located on either side of the hamlet of La Tuilière (Fig. 1), a dependency of the village of Saint-Saturnin-lès-Apt. Nowadays this area too is to some extent undergoing a rapid urbanisation. It lies only 5 km northwest of the hill at Gargas. Consequently it may with reason be considered as being well within the stratotypic area. Furthermore, several historical papers on ammonites in the type-Aptian regions, refer to fossils from places near or very close to La Tuilière, such as Saint-Saturnin d'Apt or Les Gays (KILIAN, 1896, 1910).

For continuity and comparison, it appeared desirable to add to this study of the Apt sections the Gargasian beds at the historical stratotype of the Bedoulian near Cassis-La Bédoule. There, in a quarry of the Lafarge Company, once exploited and now being rehabilitated, the lower part of the Gargasian substage is well exposed. This quarry is almost in continuity with the Bedoulian outcrops studied in 1998 (MOULLADE *et alii*); we named it the "Marcouline Quarry", because of its proximity to a wood of this name.

The following chapters address in sequence sedimentological, paleontological and geochemical data concerning the Gargasian strata in the vicinity of Cassis-La Bédoule and Apt. These areas are separated by approximately one hundred kilometers, and are situated in two discrete paleogeographic sectors. During Aptian times, the area of Cassis-La Bédoule was in an incracratonic basin named the "Sillon Sud-Provençal" (MASSE & PHILIP, 1976), that shallowed eastward but open-sea tendencies westward indicate a Pyrenean connection. On the other hand, at that time the Apt area was on the northern edge of the North-Provence platform and thus, in accordance with this geographical position, was under the influence of the Vocontian Basin (Fig. 2).

Using the methods of integrated stratigraphy, this detailed inventory of Gargasian strata from the two Aptian historical stratotypes, both characterized by high sedimentation rates and a rich fossil content, should allow us:

- to improve the precision of the biochronology of the Bedoulian-Gargasian transition that in many other areas of the world is represented by sequences either condensed or including several hiatuses,
- to compare these two areas more precisely from a paleoenvironmental and paleogeographic standpoint.

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