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A new species of mecochirid lobster, *Meyeria libanotica* (Decapoda, Glypheoidea), from the Barremian (Early Cretaceous) of Lebanon

Une nouvelle espèce de langouste mécochiridée, Meyeria libanotica (Decapoda, Glypheoidea), du Barrémien (Crétacé inférieur) du Liban

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ABSTRACT

A large sample of mecochirid lobsters (Crustacea, Decapoda, Mecochoiridae) has been recently collected from the early Barremian (Early Cretaceous) of Lebanon. The studied specimens are described as *Meyeria libanotica* sp. nov. The genus *Meyeria* M'Coy, 1849 is also revised and new combinations are proposed for two species: *Meyeria bartholomaii* (Jell, Woods and Cook, 2017) comb. nov. (Aptian, Australia), and *Meyeria rostrata* (Collins and Rasmussen, 1992) comb. nov. (Campanian–Maastrichtian, Greenland). The stratigraphic range and the palaeogeographic distribution of *Meyeria* are consequently recognized to spread from the Oxfordian (Late Jurassic) to the Maastrichtian (Late Cretaceous) and from Australia to Greenland, passing by Europe, respectively.

Keywords: Crustacea, Malacostraca, Glypheidea, Mecochoiridae, Neocomian, Sandstone of Lebanon, Shouf Sandstone Formation, Lebanon.

RÉSUMÉ

Un riche échantillon de langoustes mécochiridées (Crustacea, Decapoda, Mecochoiridae) a été récemment récolté dans le Barrémien inférieur (Crétacé inférieur) du Liban. Les spécimens étudiés sont attribués à *Meyeria libanotica* sp. nov. Le genre *Meyeria* M'Coy, 1849 est aussi révisé et de nouvelles combinaisons sont proposées pour deux espèces : *Meyeria bartholomaii* (Jell, Woods et Cook, 2017) comb. nov. (Aptien, Australie), et *Meyeria rostrata* (Collins et Rasmussen, 1992) comb. nov. (Campanien–Maastrichtien, Groenland). La répartition stratigraphique et la distribution paléogéographique de *Meyeria* s'étendent maintenant

respectivement de l'Oxfordien (Jurassique supérieur) au Maastrichtien (Crétacé supérieur) et de l'Australie au Groenland en passant par l'Europe.

Mots clés : Crustacea, Malacostraca, Glypheidea, Mecochiridae, Néocomien, Grès du Liban, Formation des Grès du Chouf, Liban.

1. Introduction

Palaeontologically, Lebanon is known for its numerous Lower Cretaceous amber outcrops and its famous Upper Cretaceous fossil Konservat-Lagerstätten (e.g., Cenomanian: Hjoula, Haqel, and En-Nammoura; Santonian: Sahel Aalma). Indeed, for the Cenomanian localities, the sub-lithographic limestones yield varied and exquisitely preserved fossils including vertebrates (fish, reptiles), invertebrates (arthropods, annelids, cephalopods, echinoderms) and terrestrial plants. Amongst the arthropods, malacostracans are the most common fossils and they were the subject of several studies (Brocchi, 1875; Fraas, 1878; Dames, 1886; Glaessner, 1945; Roger, 1946; Förster, 1984; Garassino, 1994, 2001; Larghi, 2004; Garassino and Schweigert, 2006; Schram et al., 1999; Audo and Charbonnier, 2012, 2013; Petit and Charbonnier, 2012; Charbonnier et al., 2017a, 2017b; Garassino and Pasini, 2020; Pasini et al., 2020).

Recently, a new sample of decapod crustaceans, preserved in calcareous nodules, has been collected by the co-authors R. Gèze and D. Azar, from the Lower Cretaceous (lower Barremian) of three localities (Fig. 1): one in Bqaatouta, and two localities in Mazraat Kfardibiane, all in Caza (District) Kesserouan, Mouhafazit Jabal Loubnan (Governorate Mont Liban). This discovery constitutes a novelty in the fossil record of Lebanon. The main aim of this study is to describe for the first time these Barremian crustaceans occurring in the “Grès

du Liban” also named “Grès de base” or Shouf Sandstone Formation in Lebanon. This description is accompanied by a revision of *Meyeria* M’Coy, 1849.

2. Geological setting

The Cretaceous succession of Lebanon was described and dated mainly by Dubertret and Vautrin (1937), Dubertret (1955), and Saint-Marc (1974). It has been admitted for a long time that the lowest unit of the Cretaceous is the prominent sandstone unit traditionally known as the “Grès de Base” or “C1” as termed in the geological maps of Lebanon. The classical proposed age of this division was agreed to be Neocomian, although Walley (1997) considered that the age range of this formation is problematic: in theory it could extend anywhere from terminal Tithonian to early Aptian, a time period that is around twenty million years (Gradstein and Ogg, 1996). However, by analogy with the much better known sequence to the south and in Mount Hermon (i.e. Shimron and Lang, 1989), it is likely there was a low deposition rate during Berriasian and Valanginian time, and the basal beds were probably deposited as late as Hauterivian or even early Barremian age. This unit was formalized by Walley (1983) as the “Shouf Sandstone Formation”, who considered it as one of the most distinctive units in Lebanon (Walley, 1997). Recent stratigraphical and palaeontological studies attributed an early Barremian age for this unit based on benthic foraminifera (Granier et al., 2015, 2016; Maksoud et al., 2017).

The “Grès du Liban” also named “Grès de base” or Shouf Sandstone Formation consists mostly of ferruginous, brown to white sandstone with associated clay, shale and

lignite. Some of the darker layers contain woody or coaly fragments, often including pyrite and amber (Walley, 1997; Maksoud and Azar, 2020). Locally, the “Grès du Liban” contains basaltic volcanics and reddish clayey beds, which appear to be weathered volcanic tuff. The “Grès du Liban” is very variable in thickness, ranging from a few meters to 300 m thick. It is presumed to be largely fluvial to deltaic and littoral in origin. The general trend is that the sequence passes from fluvial at the base and in the east to deltaic at the top and in the west.

3. Material and methods

The fossil decapods were collected from two localities (Fig. 1): Bqaatouta with one outcrop (El-Rouaisseh, 33° 58.383' N; 35°47.005' E; Fig. 2A), and Mazraat Kfardibiane with two outcrops separated from each other by about 300 m: Es-Sohoum (33° 59.270' N; 35° 47.421' E; Fig. 2B) and in the valley, Haqlet Es-Saiyed (33° 59.301' N; 35°47.606' E; Fig. 2C). All outcrops are in Caza (District) Kesserouan, Governorate Mount-Lebanon, Central Lebanon.

The studied sample includes 90 specimens of mecochirid lobsters. All studied specimens are preserved three-dimensionally, slightly compressed, and partially exposed on the surface of subnodular, irregular ferruginous limonite concretions. They are rarely articulated, occurring mostly as incomplete parts. The epicuticle generally is poorly preserved. Sometimes the parts of the body correspond only to inner casts. For higher-level classification, we follow Charbonnier et al. (2013) and Charbonnier et al. (2015).

Institutional abbreviations: MHN.UL, Muséum d’Histoire Naturelle de l’Université Libanaise, Faculté de Sciences II, Fanar, Lebanon ; MNHN.F, collection de Paléontologie,

Muséum national d'Histoire naturelle, Paris, France ; MIM, Mineral Museum, Beirut, Lebanon.

Anatomical abbreviations: CL, carapace length, exclusive of rostrum; CH, carapace height; P1-P5, pereopods 1 to 5; s1-s6, pleonal somites 1 to 6.

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4. Systematic palaeontology

Malacostraca Latreille, 1802

Decapoda Latreille, 1802

Glypheidea Winkler, 1881

Glypheoidea Winkler, 1881

Mecochiridae Van Straelen, 1925

Genus *Meyeria* M'Coy, 1849

Type species. *Astacus ornatus* Phillips, 1829, original designation by M'Coy (1849: 333).

Diagnosis by Feldmann et al. (2015: 23). “Subcylindrical carapace with deep cervical groove extending into the antennal groove; strongly backward and parallel postcervical and branchiocardiac grooves and weak hepatic groove; three tuberculate carinae in the gastric region; dorsal margin of carapace denticulate in the anterior one-third; short rostrum lacking supra- and subrostral teeth; strongly elongate pereopod 1 mostly pseudochelate; pereopod 2 shorter than first, mostly pseudochelate; pereopods 3-5 with terminal dactylus; subrectangular pleonal somites; subrectangular telson; exopodite with diaeresis.”

Emended diagnosis (present work). Subcylindrical carapace, laterally compressed, with ogival-shaped cross-section; pointed rostrum; antennal-ptyergostomial region with strongly concave ventral margin; cervical groove strongly oblique, ventrally joined to antennal groove, delimiting narrow cephalic region; cephalic region with generally three longitudinal carinae; postcervical and branchiocardiac grooves parallel, straight, directed toward posterior margin; postcervical groove joined ventrally to branchiocardiac groove, forming one elongate lobe; elongate and wide cardiac groove, forward-inclined, joined to postcervical groove and to dorsal margin; deep hepatic groove, curved toward posterior; short inferior groove, joined to hepatic groove and interrupted before reaching ventral margin; pleon about twice the length of carapace; subrectangular telson; pseudochelate P1, strongly elongate; P2 shorter than first; pseudochelate P3-P5 with terminal dactylus.

Included fossil species. *Meyeria aragonensis* (Garassino, Artal and Pasini, 2009) from the Oxfordian of Spain (see review in Robin et al., 2016). — *Meyeria bartholomaii* (Jell, Woods and Cook, 2017) comb. nov. from the Aptian of Queensland, Australia. — *Meyeria crofti* Ball, 1960 from the Campanian of James Ross Island, Antarctic. — *Meyeria gracilis* Glaessner, 1932 from the Hauterivian of Germany. — *Meyeria houdardi* (Van Straelen, 1936) from the Albian of France (see review in Breton et al., 2015). — *Meyeria libanotica* sp. nov. from the Barremian of Lebanon (this work). — *Meyeria ornata* (M'Coy, 1849) from the Hauterivian of United Kingdom, France, Germany, The Netherlands, and Switzerland, and from the Aptian of United Kingdom (see Simpson and Middleton, 1985). — *Meyeria rostrata* (Collins and Rasmussen, 1992) comb. nov. from the late Campanian and Maastrichtian of West Greenland. — *Meyeria serratosae* (Dupuy de Lôme and de la Revilla, 1956) from the Jurassic of Spain (see review in Charbonnier et al., 2013).

Remarks. *Meyeria? harveyi* Woodward, 1900 from the Late Cretaceous of British Columbia, Canada has not been considered because the description is very scant with no figure (Woodward, 1900). Moreover, Feldmann et al. (1995) reported that the holotype has been lost. Agreeing with Förster (1971) and Feldmann et al. (1995), we consider this species as a *nomen dubium*.

Recently, Jell et al. (2017) described *Mecochirus bartholomaii* from the Aptian of Queensland, Australia. Careful examination of the figures provided by the authors lead us to identify morphological characters, which are diagnostic of *Meyeria*, especially the elongate and wide cardiac groove joined to the dorsal margin, and the short inferior groove, interrupted before reaching the ventral margin. This carapace groove pattern is typical of *Meyeria*. Hence, the new combination *Meyeria bartholomaii* (Jell, Woods and Cook, 2017) is here proposed.

Collins and Rasmussen (1992) described *Mecochirus rostratus* from the late Campanian and Maastrichtian of West Greenland. Careful examination of the dorsal view of the paratype figured by Collins and Rasmussen (1992: fig. 3b) lead us to identify morphological characters, which are diagnostic of *Meyeria*. Indeed, the paratype shows the elongate and wide cardiac groove, which is also clearly described in the text (“a faint groove passes upward from the postcervical furrow to the dorsal margin”) but not recognized or named as such. Thus, the new combination *Meyeria rostrata* (Collins and Rasmussen, 1992) is here proposed.

Meyeria libanotica Charbonnier, Audo and Garassino sp. nov.

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Figs 3-6

Etymology. The specific epithet refers to Lebanon (Middle East) where the species was collected.

Type material. Holotype MHN.UL.P.25439/1V from Mazraat Kfardibiane valley (Haqlet Es-Saiyed outcrop). — 10 paratypes (MHN.UL.P.25439/2V–9V, MNHN.F.A42022, A42023) from Mazraat Kfardibiane valley (Haqlet Es-Saiyed outcrop). — 12 paratypes (MNH.UL.P.25451/1–7, MIM 25451/1, MNHN.F.A42018–A42021) from Bqaatouta (El-Rouaisseh outcrop).

Type locality. Haqlet Es-Saiyed, Mazraat Kfardibiane, Caza Kesserouane, Governorate Mount-Lebanon (Kadaa Kesserouane, Mouhafazit Jabal Loubnan), Central Lebanon.

Type age. Early Cretaceous, early Barremian.

Additional examined material. 47 specimens MNH.UL.P.25451/7–53 from Bqaatouta (El-Rouaisseh outcrop). — 10 specimens MHN.UL.P.25439/1-10 from Mazraat Kfardibiane (Es-Sohoum outcrop). — 10 specimens MHN.UL.P.25439/10V–19V from Mazraat Kfardibiane valley (Haqlet Es-Saiyed outcrop).

Description. *Carapace.* Subcylindrical carapace, laterally compressed, with ogival cross-section (holotype: CL= *ca* 45 mm, CH= *ca* 22 mm); short, pointed rostrum, unarmed, with median dorsal depression; antennal-ptyergostomial region with strongly concave ventral margin; deep cervical groove strongly oblique, intercepting dorsal margin at angle of *ca* 45°, ventrally joined to antennal groove, delimiting narrow cephalic region; smooth cephalic region with three longitudinal carinae: strongly raised and tuberculated antennal and gastro-orbital carinae, raised and smooth orbital carina, slightly curved downward; space between antennal and gastro-orbital carinae about twice larger than between gastro-orbital and orbital carinae; postcervical and branchiocardiac grooves parallel, strongly inclined, directed toward posterior margin; postcervical groove joined ventrally to branchiocardiac groove, forming one elongate, straight lobe; elongate, wide cardiac groove, forward-inclined, joined to postcervical groove and to dorsal margin; deep hepatic groove, curved toward posterior, surrounding

subcircular hepatic lobe; short inferior groove, joined to hepatic groove and interrupted before reaching ventral margin; strongly raised and tuberculate hepatic ridge; branchial region covered by tubercles decreasing in size from ventral margin to branchiocardiac groove; raised pterygostomial region uniformly covered by tubercles; smooth cardiac, gastric and antennal regions.

Pleon. Pleon (including telson) about twice the length of carapace; short s1; very large s2 with rounded anterior and ventral margins and straight posterior margin; s2 pleuron with longitudinal carina on middle portion; s3-s5 almost same in shape and size, with subtriangular pleura; s3-s5 pleura with longitudinal carina on middle portion; short s6 with triangular pleuron; subrectangular telson with subovate distal extremity and median groove limited by longitudinal carinae; proximal part with axial pair of tubercles; lateral margins with longitudinal carinae; smooth dorsal surface.

Thoracic appendages. P1-P5 poorly preserved; subchelate P1-P2; very elongate P1; P1 merus, carpus, and propodus with longitudinal rows of tubercles; rectangular P1 merus with spiny ventral margin; elongate P1 propodus almost equal to the length of carapace, with ventral margin bearing one strong distal spine directed forward; P3-P5 decreasing in size posteriorly, slender and almost smooth.

Pleonal appendages. Uropods poorly preserved, connected to smooth basipodite; each with median longitudinal carina; uropodal exopod with serrate outer margin, and straight diaraesis; uropodal endopod with fibrous, flexible distal portion.

Discussion. The new species shows a carapace groove pattern diagnostic of *Meyeria*, especially the elongate and wide cardiac groove joined to the dorsal margin, the subcircular hepatic groove, and the short inferior groove. *Meyeria libanotica* sp. nov. differs from all

other species of *Meyeria* by its strong hepatic carina (absent in all other species). *Meyeria libanotica* differs from *M. ornata*, *M. rostrata*, and *M. bartholomaii* by its short, unarmed rostrum (vs spiny in *M. ornata*, elongate and spiny in *M. bartholomaii* and *M. rostrata*). *Meyeria libanotica* differs from *M. aragonensis* by its three longitudinal cephalic carinae (vs only one cephalic carina in *M. aragonensis*). *Meyeria libanotica* sp. nov. differs from many other species of *Meyeria* by its smooth cardiac, gastric, and cephalic regions (vs covered by small or strong tubercles in *M. aragonensis*, *M. gracilis*, *M. houdardi*, *M. ornata*, and *M. serratosae*; with scattered tubercles in *M. bartholomaii* and *M. crofti*).

The hepatic carina observed in *Meyeria libanotica* sp. nov. is reminiscent of that observed in *Atherfieldastacus* Simpson in Robin et al., 2016, but does not extend posteriorly into ventral branchial ridge (ridge “r1” of González-León et al., 2014). Similarly, the subrectangular telson with median groove and proximal axial pair of tubercles of *M. libanotica* sp. nov. is also observed in *Atherfieldastacus magnus* (M’Coy, 1849) as well as in *Mecochirus longimanatus* (Schlotheim, 1820) regarding the subrectangular shape of the telson. Associated with the very elongate, slender P1 pereopods, these morphological characters add to the definition of the family Mecochiridae.

5. Conclusion

Meyeria libanotica sp. nov. is the first occurrence of the genus in the Barremian. Taking into account the present review, *Meyeria* M’Coy, 1849 includes nine species. Thus, the stratigraphic range and palaeogeographic distribution of the genus spread from the Oxfordian (Late Jurassic) to the Maastrichtian (Late Cretaceous) and from Australia to Greenland, through Europe, respectively. Thorough research is now required to better

understand the Cretaceous diversification and biogeographic distribution of mecochirid lobsters.

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References

- Audo, D., Charbonnier, S., 2012. New Nisto of Slipper Lobster (Decapoda, Scyllaridae) from the Hadjoula Lagerstätte (Late Cretaceous, Lebanon). *Journal of Crustacean Biology* 32 (4), 583–590, <https://doi.org/10.1163/193724012X634189>.
- Audo, D., Charbonnier, S., 2013. Late Cretaceous crest-bearing shrimps from the Sahel Alma Lagerstätte of Lebanon. *Acta Palaeontologica Polonica* 58 (2), 335–349, <https://doi.org/10.4202/app.2011.0056>.
- Ball, H.W., 1960. Upper Cretaceous Decapoda and Serpulidae from James Ross Island, Graham Land. *Falkland Islands Dependencies Survey Scientific Reports* 24, 1–30.

- Breton, G., Néraudeau, D., Dépré, E., 2015. Mecochiridae (Crustacea, Decapoda, Glypheidea) de l'Albien et du Cénomaniens de France. *Annales de Paléontologie* 101 (1), 55–64, <https://doi.org/10.1016/j.annpal.2015.01.001>.
- Brocchi, P., 1875. Note sur une nouvelle espèce de crustacé fossile (*Penaeus libanensis*). *Bulletin de la Société géologique de France* 3, 609–610.
- Charbonnier, S., Audo, D., Barriol, V., Garassino, A., Schweigert, G., Simpson, M., 2015. Phylogeny of fossil and extant glypheid and litogastrid lobsters (Crustacea, Decapoda) as revealed by morphological characters. *Cladistics* 31, 231–249, <https://doi.org/10.1111/cla.12088>.
- Charbonnier, S., Audo, D., Garassino, A., Hyžný, M., 2017a. Fossil Crustacea of Lebanon. *Mémoires du Muséum national d'Histoire naturelle, Paris* 210, 1–252.
- Charbonnier, S., Garassino, A., Schweigert, G., Simpson, M., 2013. A worldwide review of fossil and extant glypheid and litogastrid lobsters (Crustacea, Decapoda, Glypheoidea). *Mémoires du Muséum national d'Histoire naturelle, Paris* 205, 1–304.
- Charbonnier, S., Teruzzi, G., Audo, D., Lasseron, M., Haug, C., Haug, J.T. 2017b. New thylacocephalans from the Cretaceous Lagerstätten of Lebanon. *BSGF-Earth Sciences Bulletin* 188 (3), 19, <https://doi.org/10.1051/bsgf/2017176>.
- Collins, J.S.H., Rasmussen, H.W., 1992. Upper Cretaceous–Lower Tertiary decapod crustaceans from West Greenland. *Grønland Geologiske Undersøgelse* 162, 1–46.
- Dames, W., 1886. Ueber einige Crustaceen aus den Kreideablagerungen des Libanon. *Zeitschrift der Deutschen Geologischen Gesellschaft* 38 (3), 551–576.
- Dubertret, L., 1953. Carte géologique au 50 000^e, Feuille de Zahlé. République Libanaise, Ministère des Travaux publics, Beyrouth.
- Dubertret, L., 1955. Carte géologique du Liban au 1/200 000^e. République Libanaise, Ministère des Travaux publics, Beyrouth.

- Dubertret, L., Vautrin, H., 1937. Révision de la stratigraphie du Crétacé du Liban. Notes et Mémoires, Haut-Commissariat de la République Française en Syrie et au Liban, Tome 2, 43–73.
- Dupuy de Lôme, E., De La Revilla, J., 1956. Dos especies fósiles nuevas en las provincias de Valencia y Alicante. Notas y Comunicaciones del Instituto Geológico y Minero de España 43, 3–7.
- Feldmann, R.M., Schweitzer, C.E., Karasawa, H., 2015. Part R, Revised, Volume 1, Chapter 8I. Systematic Descriptions: Infraorder Glypheidea. Treatise Online 68, 1–28, <https://doi.org/10.17161/to.v0i0.5028>.
- Feldmann, R.M., Vega, F.J., García-Barrera, P., Rico-Montiel, R., Martínez López, L. 1995. A new species of *Meyeria* (Decapoda: Mecochiridae) from the San Juan Raya Formation (Aptian: Cretaceous), Puebla state, Mexico. Journal of Paleontology 69(2), 402–406, <https://doi.org/10.1017/S0022336000034740>.
- Förster, R., 1971. Die Mecochiridae, eine spezialisierte Familie der mesozoischen Glypheoidea (Crustacea, Decapoda). Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen 137 (3), 396-421.
- Förster, R., 1984. Bärenkrebse (Crustacea, Decapoda) aus dem Cenoman des Libanon und dem Eozän Italiens. Mitteilungen der Bayerischen Staatssammlung für Paläontologie und historische Geologie 24, 57–66.
- Fraas, O., 1878. Geologisches aus dem Libanon. Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg 34, 257–391.
- Garassino, A., 1994. The macruran decapod crustaceans of the Upper Cretaceous of Lebanon. Paleontologia Lombarda Nuova serie, Società italiana di Scienze naturali e del Museo civico di Storia naturale in Milano 3, 3–27.

- Garassino, A., 2001. New decapod crustaceans from the Cenomanian (Upper Cretaceous) of Lebanon. *Atti della Società italiana di Scienze naturali e del Museo civico di Storia naturale in Milano* 141 (2), 237–250.
- Garassino, A., Pasini, G., 2020. A new fury lobster (Crustacea, Decapoda, Synaxidae) from the Upper Cretaceous (Cenomanian) of Lebanon. *Palaeodiversity* 13, 131–133, <https://doi.org/10.18476/pale.v13.a10>.
- Garassino, A., Artal, P., Pasini, G., 2009. — *Jabaloya aragonensis* n. gen., n. sp. (Crustacea, Decapoda, Mecochiridae) and *Cedrillosia jurassica* n. gen., n. sp. (Crustacea, Decapoda, Glypheidae) from the Upper Jurassic of Teruel Province (Aragón, Spain). *Atti della Società italiana di Scienze naturali e del Museo civico di Storia naturale in Milano* 150 (2), 197–206.
- Garassino, A., Schweigert, G., 2006. *Cretasergestes sahelalmaensis* n. gen., n. sp. (Crustacea, Decapoda, Sergestidae) and *Cancrios libanensis* n. sp. (Crustacea, Decapoda, Palinuridae) from the Late Cretaceous (Cenomanian) of Lebanon. *Atti della Società italiana di Scienze naturali e del Museo civico di Storia naturale in Milano* 147 (1), 69–78.
- Glaessner, M.F., 1932. Neue Krebsreste aus der Kreide. *Jahrbuch der Preussischen Geologischen Landesanstalt* 53, 577–586.
- Glaessner, M.F., 1945. Cretaceous Crustacea from Mount Lebanon, Syria. *Annals and Magazine of Natural History* 11 (12), 694–707, <https://doi.org/10.1080/00222934508654776>.
- González-León, O., Moreno-Bedmar, J.A., Vega, F.J., 2014. Morphology and ontogeny of the fossil lobster *Meyeria magna* M'Coy, 1849 (Astacidae, Mecochiridae) from the Lower Cretaceous (Lower Aptian) of Mexico, United Kingdom and Spain. *Neues Jahrbuch für Geologie und Paläontologie - Abhandlungen* 271 (1), 49–68, <https://doi.org/10.1127/0077-7749/2014/0376>.

- Gradstein, F.M., Ogg, J., 1996. A Phanerozoic time scale. Episodes 19, 3–4.
- Granier, B., Azar, D., Maksoud, S., Gèze, R., Habchi, R., 2015. New fossiliferous sites with Barremian Charophyta in the “Grès du Liban” auct. (Lebanon), with a critical perspective regarding the nature of *Munieria* Deecke, 1883. Carnets de Géologie 15 (15), 199–229, <http://paleopolis.rediris.es/cg/15/15/CG1515.pdf>.
- Granier, B., Toland, C., Gèze, R., Azar, D., Maksoud, S., 2016. Some steps toward a new story for the Jurassic-Cretaceous transition in Mount Lebanon. Carnets de Géologie 16 (8), 247–269, <http://paleopolis.rediris.es/cg/16/08/CG1608.pdf>.
- Jell, P.A., Woods, J.T., Cook, A.G., 2017. *Mecochirus* Germar (Decapoda: Glypheoidea) in the Lower Cretaceous of Queensland. Alcheringa 41, 514–523, <https://doi.org/10.1080/03115518.2017.1318169>.
- Larghi, C., 2004. Brachyuran Decapod Crustacea from the Upper Cretaceous of Lebanon. Journal of Paleontology 78 (3), 528–541, [https://doi.org/10.1666/0022-3360\(2004\)078<0528:BDCFTU>2.0.CO;2](https://doi.org/10.1666/0022-3360(2004)078<0528:BDCFTU>2.0.CO;2).
- Latreille, P.A., 1802. Histoire naturelle, générale et particulière des crustacés et des insectes. Tome 3. F. Dufart, Paris, 467 p.
- M'Coy, F., 1849. On the Classification of some British Fossil Crustacea, with Notices of new Forms in the University Collection at Cambridge. The Annals and Magazine of Natural History (series 2) 4, 161–179, 330–335, <https://doi.org/10.1080/03745486009494810>.
- Maksoud, S., Azar, D., 2020. Lebanese amber: latest updates. Palaeoentomology 3 (2), 125–155, <https://doi.org/10.11646/palaeoentomology.3.2.2>.
- Maksoud, S., Azar, D., Granier, B., Gèze, R., 2017. New data on the age of the Lower Cretaceous amber outcrops of Lebanon. Palaeoword 26 (2), 331–338, <https://doi.org/10.1016/j.palwor.2016.03.003>.

- Pasini, G., Poore, G.C.B., Garassino, A. 2020. A new ghost shrimp (Axiidea, Callianopsidae) from the Late Cretaceous (Cenomanian) of Hadjoula, Lebanon. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen* 297 (2), 217–225, <https://doi.org/10.1127/njgpa/2020/0922>
- Petit, G., Charbonnier, S., 2012. Fossil sponge gemmules, epibionts of *Carpopenaeus garassinoi* n. sp. (Crustacea, Decapoda) from the Sahel Alma Lagerstätte (Late Cretaceous, Lebanon). *Geodiversitas* 34 (2), 359–372. <https://doi.org/10.5252/g2012n2a6>.
- Phillips, J., 1829. *Illustrations of the geology of Yorkshire*. Thomas Wilson and sons, York, 192 p.
- Robin, N., Charbonnier, S., Merle, D., Simpson, M., Petit, G., Fernandez, S., 2016. Bivalves on mecochirid lobsters from the Aptian of the Isle of Wight: Snapshot on an Early Cretaceous palaeosymbiosis. *Palaeogeography, Palaeoclimatology, Palaeoecology* 453, 10–19, <https://doi.org/10.1016/j.palaeo.2016.03.025>.
- Roger, J., 1946. Invertébrés des couches à poissons du Crétacé supérieur du Liban. *Mémoires de la Société géologique de France (Nouvelle série)* 51, 1–92.
- Saint-Marc, P., 1974. Étude stratigraphique et micropaléontologique de l’Albien, du Cénomanien et du Turonien du Liban. *Muséum National d’Histoire Naturelle, Paris. Notes et Mémoires sur le Moyen-Orient* 13 (1), 1–342.
- Schlotheim, E.F., von, 1820. *Die Petrefactenkunde auf ihrem jetzigen Standpunkte durch die Beschreibung seiner Sammlung versteinerner und fossiler Überreste des Thier- und Pflanzenreichs der Vorwelt erläutert*. Becker, Gotha, 1–457.
- Schram, F.R., Hof, C.H.J., Steeman, F.A., 1999. Thylacocephala (Arthropoda: Crustacea?) from the Cretaceous of Lebanon and implications for thylacocephalan systematics. *Palaeontology* 42 (5), 769–797, <https://doi.org/10.1111/1475-4983.00097>.

- Shimron, A.F., Lang, B., 1989. Cretaceous magmatism along the southeastern flanks of Mount Hermon. *Israel Journal of Earth Sciences* 38, 125–142.
- Simpson, M.I., Middleton, R., 1985. Gross morphology and the mode of life of two species of lobster from the Early Cretaceous of England: *Meyeria ornata* (Phillips) and *Meyerella magna* (M'Coy). *Transactions of the Royal Society of Edinburgh* 76, 203–215, <https://doi.org/10.1017/S0263593300010440>.
- Van Straelen, V., 1925. Contribution à l'étude des Crustacés décapodes de la période jurassique. *Mémoires de la Classe des Sciences de l'Académie royale de Belgique*, 2^e série, 7, 1–462.
- Van Straelen, V., 1936. Crustacés décapodes nouveaux ou peu connus de l'époque Crétacique. *Bulletin du Musée royal d'histoire naturelle de Belgique* 12 (45), 1–50.
- Walley, C.D., 1983. A revision of the Lower Cretaceous stratigraphy of Lebanon. *Geologische Rundschau* 72, 377–388.
- Walley, C.D., 1997. The Lithostratigraphy of Lebanon: A Review. *Lebanese Science Bulletin* 10 (1), 81–108.
- Winkler, T.C., 1881. Étude carcinologique sur les genres *Pemphix*, *Glyphea* et *Araeosternus*. *Archives du Musée Teyler*, Série 2, 1 (2), 73–124.
- Woodward, H., 1900. Further notes on podophthalmous crustaceans from the Upper Cretaceous formation of British Columbia. *Geological Magazine, New Series* 7 (10), 432–435, <https://doi.org/10.1017/S0016756800183311>.

Figure captions

Fig. 1. Geological map of the area of study in Caza Kesserouan, Governorate Mount-Lebanon, Central Lebanon (adapted from Dubertret, 1953). The localities yielding specimens of *Meyeria libanotica* sp. nov. are Bqaatouta with El-Rouaïsseh outcrop and Mazraat Kfardibiane with Es-Sohoum and Haqlet Es-Saiyed outcrops.

Carte géologique de la zone d'étude dans le District de Kesserouan, Gouvernorat du Mont-Liban, Liban central (adaptée d'après Dubertret, 1953). Les localités livrant des spécimens de Meyeria libanotica sp. nov. sont Bqaatouta avec l'affleurement d'El-Rouaïsseh et Mazraat Kfardibiane avec les affleurements d'Es-Sohoum et de Haqlet Es-Saiyed.

Fig. 2. Studied localities in Caza Kesserouan, Governorate Mount-Lebanon, Central Lebanon
A, Outcrop of Bqaatouta (El-Rouaïsseh, 33° 58.383' N; 35°47.005'). **B**, Outcrop of Mazraat Kfardibiane (Es-Sohoum, 33° 59.270' N; 35° 47.421' E). **C**, Outcrop of Mazraat Kfardibiane valley (Haqlet Es-Saiyed, 33° 59.301' N; 35°47.606' E). The geologist shown in the images for scale is the co-author R. Gèze. Photographs: D. Azar.

Localités étudiées dans le District de Kesserouan, Gouvernorat du Mont-Liban, Liban central. A, Affleurement de Bqaatouta (El-Rouaïsseh, 33° 58.383' N; 35°47.005'). B, Affleurement de Mazraat Kfardibiane (Es-Sohoum, 33° 59.270' N; 35° 47.421' E). C, Affleurement de la vallée de Mazraat Kfardibiane (Haqlet Es-Saiyed, 33° 59.301' N; 35°47.606' E). Le géologue, qui donne l'échelle sur les photos, est le co-auteur R. Gèze. Photographies : D. Azar.

Fig. 3. *Meyeria libanotica* sp. nov. from the Barremian of Central Lebanon. **A-D**, holotype MHN.UL.P.25439/1V from Haqlet Es-Saiyed, carapace in left lateral (A), and dorsal (B, C) views, interpretative line drawing (D). Note the carapace was whitened with ammonium

chloride sublimate (C) to highlight the groove pattern. **E-H**, paratype MHNN.F.A42018 (Gèze coll.) from El-Rouaïsseh, carapace and pereopods, left lateral (E) and right lateral (F) views, interpretative line drawings (G, H). Abbreviations: **a**, branchiocardiac groove; **ac**, antennal carina; **an**, antennal notch; **b**, antennal groove; **b₁**, hepatic groove; **c**, postcervical groove; **cd**, cardiac groove; **ct**, carapace; **dm**, dorsal margin; **e_{1e}**, cervical groove; **gc**, gastro-orbital carina; **hr**, hepatic carina; **i**, inferior groove; **oc**, orbital carina; **P1-P5**, pereopods 1 to 5; **s1-s2**, pleonal somites 1 to 2; **vm**, ventral margin. Scale bars: 10 mm. Photographs: L. Cazes (A-C), C. Lemzaouda (E, F). Line drawings: S. Charbonnier.

Meyeria libanotica sp. nov. du Barrémien du Liban central. **A-D**, holotype MHN.UL.P.25439/IV de Haqlet Es-Saiyed, carapace en vue latérale gauche (A) et vues dorsales (B, C), dessin interprétatif (D). Notez que la carapace a été blanchie au chlorure d'ammonium (C) pour mettre en évidence les sillons. **E-H**, paratype MHNN.F.A42018 (coll. Gèze) d'El-Rouaïsseh, carapace et péréiopodes, vues latérales gauche (E) et droite (F), dessins interprétatifs (G, H). Abréviations: **a**, sillon branchiocardiaque ; **ac**, carène antennaire ; **an**, encoche antennaire ; **b**, sillon antennaire ; **b₁**, sillon hepatic ; **c**, sillon postcervical ; **cd**, sillon cardiaque ; **ct**, carapace ; **dm**, marge dorsale ; **e_{1e}**, sillon cervical ; **gc**, carène gastro-orbitaire ; **hr**, carène hépatique ; **i**, sillon inférieur ; **oc**, carène orbitaire ; **P1-P5**, péréiopodes 1 à 5 ; **s1-s2**, somites pléonaux 1 à 2 ; **vm**, marge ventrale. Barres d'échelle : 10 mm. Photographies: L. Cazes (A-C), C. Lemzaouda (E, F). Dessins : S. Charbonnier.

Fig. 4. *Meyeria libanotica* sp. nov. from the Barremian of Central Lebanon. **A-D**, paratype MHN.UL.P25451/6 from El-Rouaïsseh, limonitized carapace in right lateral (A), left lateral (B) and dorsal (C, D) views. Note the carapace was whitened with ammonium chloride sublimate (D) to highlight the groove pattern, especially the elongate cardiac

groove. **E-F**, paratype MHNN.F.A72019 (Gèze coll.) from El-Rouaïsseh, carapace and pereopods, left lateral view and interpretative line drawing. **G-I**, paratype MHN.UL.P.25439/2V from Haqlet Es-Saiyed, subcomplete specimen with carapace, pleon and fragments of pereopods, right lateral (G) and left lateral (H) views, interpretative line drawing of carapace (I). Abbreviations: **a**, branchiocardiac groove; **ac**, antennal carina; **an**, antennal notch; **b**, antennal groove; **b₁**, hepatic groove; **c**, postcervical groove; **cd**, cardiac groove; **dm**, dorsal margin; **eie**, cervical groove; **gc**, gastro-orbital carina; **hr**, hepatic carina; **i**, inferior groove; **me**, merus; **oc**, orbital carina; **on**, orbital notch; **P1-P5**, pereopods 1 to 5; **vm**, ventral margin. Scale bars: 10 mm. Photographs: L. Cazes (A-D), C. Lemzaouda (E, G, H). Line drawings: S. Charbonnier.

Meyeria libanotica sp. nov. du Barrémien du Liban central. **A-D**, paratype MHN.UL.P25451/6 from El-Rouaïsseh, carapace limonitisée en vues latérales droite (A) et gauche (B) et vues dorsales (C, D). Notez que la carapace a été blanchie au chlorure d'ammonium (D) pour mettre en évidence les sillons, notamment le long sillon cardiaque. **E-F**, paratype MHNN.F.A72019 (coll. Gèze) d'El-Rouaïsseh, carapace et péréiopodes, vue latérale gauche et dessin interprétatif. **G-I**, paratype MHN.UL.P.25439/2V de Haqlet Es-Saiyed, subcomplete spécimen subcomplet avec carapace, pléon et fragments de péréiopodes, vues latérales droite (G) et gauche (H), dessin interprétatif de la carapace (I). Abréviations : **a**, sillon branchiocardiaque ; **ac**, carène antennaire ; **an**, encoche antennaire ; **b**, sillon antennaire ; **b₁**, sillon hépatique ; **c**, sillon postcervical ; **cd**, sillon cardiaque ; **dm**, marge dorsale ; **eie**, sillon cervical ; **gc**, carène gastro-orbitaire ; **hr**, carène hépatique ; **i**, sillon inférieur ; **me**, mérus ; **oc**, carène orbitaire ; **on**, encoche orbitaire ; **P1-P5**, péréiopodes 1 à 5 ; **vm**, marge ventrale. Barres d'échelle : 10 mm. Photographies: L. Cazes (A-D), C. Lemzaouda (E, G, H). Dessins : S. Charbonnier.

Fig. 5. *Meyeria libanotica* sp. nov. from the Barremian of Haqlet Es-Saiyed, Central Lebanon.

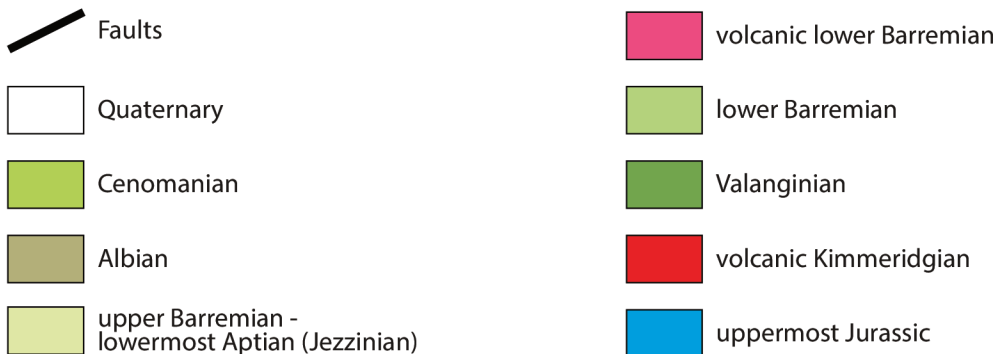
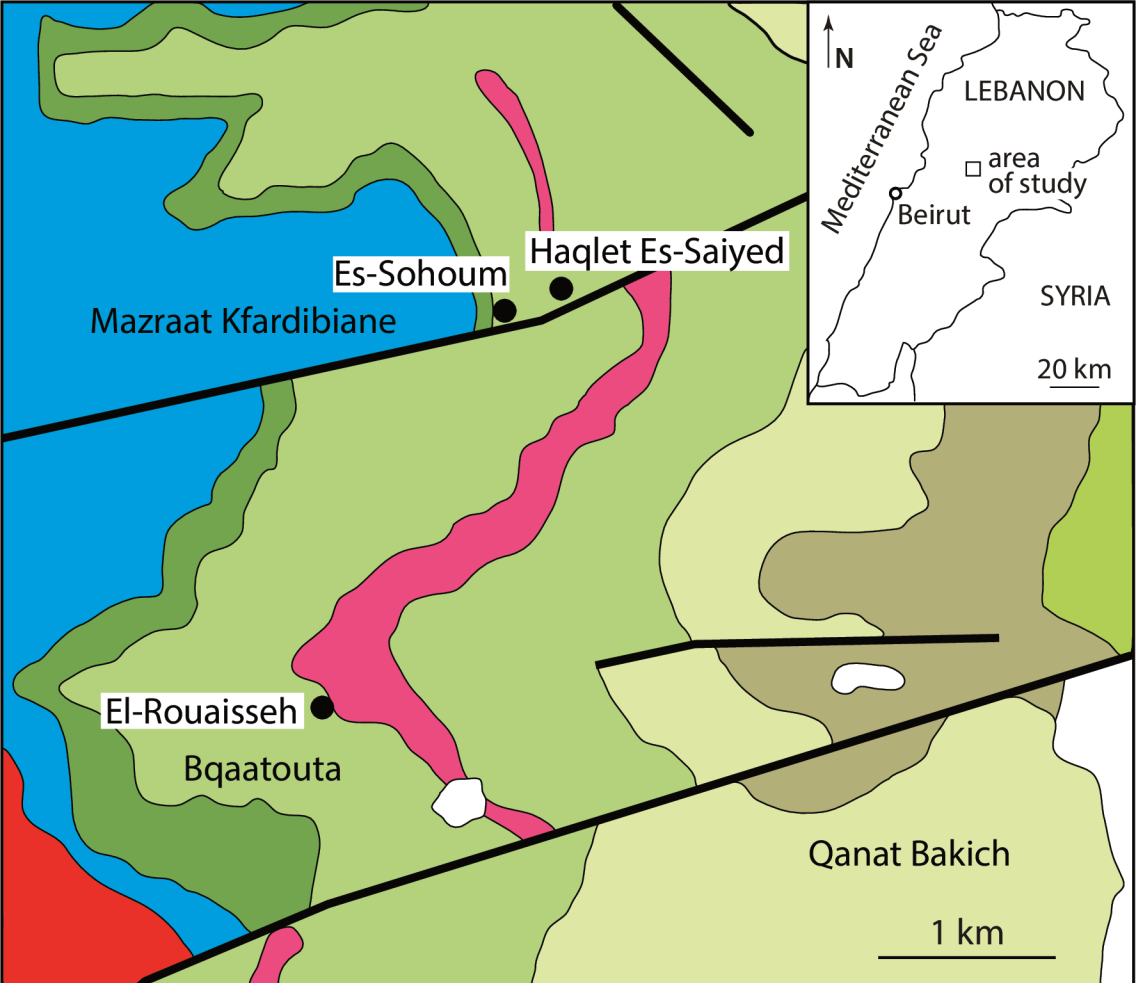
A-E, paratype MHN.UL.P.25439/3V, subcomplete specimen in right lateral view (A), interpretative line drawing of carapace (B), detail of pleon and tail fan (C) and interpretative line drawing (D), closed-up of dorsal surface of carapace showing the rostrum (E). **F-H**, paratype MHN.UL.P.25439/4V, carapace preserved in limonitized nodule, right lateral (F), left lateral (G) and dorsal (H) views. **I-J**, paratype MHN.UL.P.25439/9V, isolated P1 propodus with strong distal spine on ventral margin and longitudinal rows of tubercles on outer surface, interpretative line drawing (J). Abbreviations: **a**, branchiocardiac groove; **ac**, antennal carina; **an**, antennal notch; **b**, antennal groove; **bap**, uropodal basipodite; **b₁**, hepatic groove; **c**, postcervical groove; **cd**, cardiac groove; **dm**, dorsal margin; **ex**, uropodal exopod; **en**, uropodal endopod; **e_{1e}**, cervical groove; **gc**, gastro-orbital carina; **hr**, hepatic carina; **i**, inferior groove; **me**, merus; **oc**, orbital carina; **on**, orbital notch; **r**, rostrum; **sp**, distal spine; **s₄-s₆**, pleonal somites 4 to 6; **t**, telson; **vm**, ventral margin. Scale bars: 10 mm. Photographs: C. Lemzaouda (A, C, E, I), L. Cazes (F-H). Line drawings: S. Charbonnier.

Meyeria libanotica sp. nov. du Barrémien de Haqlet Es-Saiyed, Liban central. **A-E**, paratype MHN.UL.P.25439/3V, spécimen subcomplet en vue latérale droite (A), dessin interprétatif de la carapace (B), pléon et éventail caudal (C) et dessin interprétatif (D), détail de la surface dorsale de la carapace montrant le rostre (E). **F-H**, paratype MHN.UL.P.25439/4V, carapace préservée dans un nodule limonitisé, vues latérales droite (F) et gauche (G) et vue dorsale (H). **I-J**, paratype MHN.UL.P.25439/9V, propodus P1 isolé, muni d'une grosse épine distale sur la marge ventrale et de rangées longitudinales de tubercules sur la surface externe, dessin interprétatif (J). Abréviations : **a**, sillon branchiocardiaque ; **ac**, carène antennaire ; **an**, encoche antennaire ; **b**, sillon antennaire ; **bap**, basipodite de l'uropode ; **b₁**, sillon hépatique ; **c**, sillon postcervical ; **cd**,

sillon cardiaque ; **dm**, marge dorsale ; **ex**, exopode de l'uropode ; **en**, endopode de l'uropode ; **eie**, sillon cervical ; **gc**, carène gastro-orbitaire ; **hr**, carène hépatique ; **i**, sillon inférieur ; **me**, mérus ; **oc**, carène orbitaire ; **on**, encoche orbitaire ; **r**, rostre ; **sp**, épine distale ; **s4-s6**, somites pléonaux 4 à 6 ; **t**, telson ; **vm**, marge ventrale. Barres d'échelle : 10 mm. Photographies : C. Lemzaouda (A, C, E, I), L. Cazes (F-H). Dessins : S. Charbonnier.

Fig. 6. *Meyeria libanotica* sp. nov. from the Barremian of Central Lebanon. **A-B**, paratype MHN.UL.P.25439/5V from Haqlet Es-Saiyed, subcomplete specimen with carapace connected to pleon, right lateral view (A) and interpretative line drawing (B). **C-D**, paratype MHN.UL.P25451/7 from El-Rouaïsseh, limonitized specimen with complete pleon, left lateral (C) and right lateral (D) views. Abbreviations: **bap**, uropodal basipodite; **ct**, carapace; **di**, diaeresis; **ex**, uropodal exopod; **en**, uropodal endopod; **P1-P5**, pereopods 1 to 5; **s1-s6**, pleonal somites 1 to 6; **t**, telson; **vm**, ventral margin. Scale bars: 10 mm. Photographs: C. Lemzaouda (A, C, E, I), L. Cazes (F-H). Line drawing: S. Charbonnier.

Meyeria libanotica sp. nov. du Barrémien du Liban central. **A-B**, paratype MHN.UL.P.25439/5V de Haqlet Es-Saiyed, spécimen subcomplet avec carapace connectée au pléon, vue latérale droite (A) et dessin interprétatif (B). **C-D**, paratype MHN.UL.P25451/7 de El-Rouaïsseh, spécimen limonitisé avec pléon complet, vues latérales gauche (C) et droite (D). Abréviations : **bap**, basipodite de l'uropode ; **ct**, carapace ; **di**, diérèse ; **ex**, exopode de l'uropode ; **en**, endopode de l'uropode ; **P1-P5**, péréiopodes 1 à 5 ; **s1-s6**, somites pléonaux 1 à 6 ; **t**, telson ; **vm**, marge ventrale. Barres d'échelle : 10 mm. Photographies : C. Lemzaouda (A, C, E, I), L. Cazes (F-H). Dessins : S. Charbonnier.



A**B**

