

Thoracic appendages. The 3rd maxilliped is only partially preserved in two specimens (MSNB 8237; MSNM i10732): it is possible to observe just fragments of the dactylus and part of the propodus. The pereiopods are more or less preserved in all the specimens. The first pair (see Fig. 44) is very developed, with two strong chelae of the same size; its propodus is strong, longer than the merus, with internal dactylus; the carpus is short and stocky; the merus is elongated and very strong. The surface of these elements is fringed by granules and spine-shaped tubercles, which are well developed particularly along the internal margins, where they seem to be arranged in rows. The dactylus and the

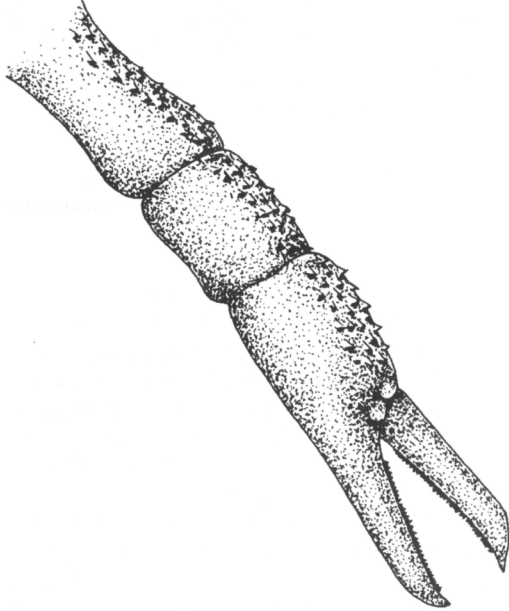
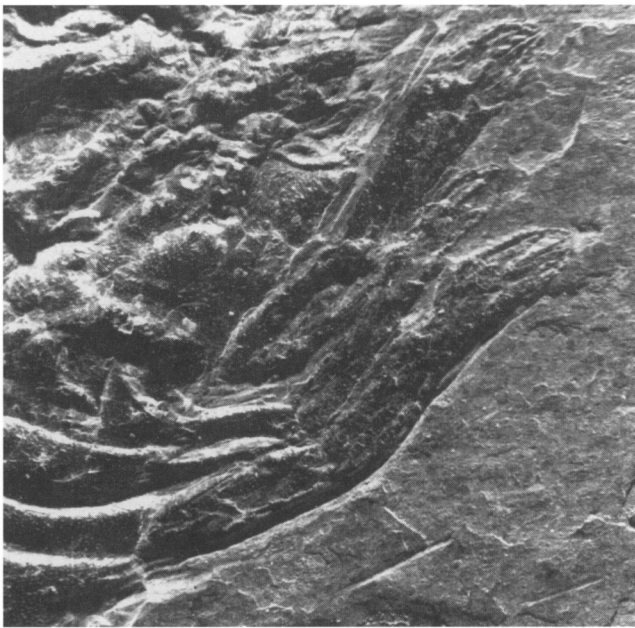


Fig. 44 - *Glaessnericaris macrochela* n. gen. n. sp., first pereiopod with ornamentation, line drawing



index, just slightly bent at their apex, are supplied with small teeth on the internal margin (MSNM i10736). The II-IV pereiopods (see Fig. 45) have about the same length and their elements are thin and elongated and are supplied with chelae. The V pereiopod has a terminal dactylus.

Abdominal appendages. The five pairs of pleopods are badly preserved in some specimens; they are made of a subrectangular sympodite with two multiarticulate flagella.

#### Observations

The general morphological features allow to ascribe the genus *Glaessnericaris* n. gen. (see Fig. 46) to the infraorder Astacidea Latreille, 1803, particularly to the family Platychelidae Glaessner, 1931. The family was created by Glaessner in order to include the forms of the genus *Platychela* Glaessner, 1931 from the Carnian (Lower Upper Triassic) of Lunz (Austria) and Raibl (Carnia, NE Italy). The genus *Platychela* shows several affinities with *Glaessnericaris* n. gen.: big-sized chelae of the first pair of pereiopods, similar carapace with the presence of the cervical, postcervical and branchiocardiac grooves; the trend of the abdominal somites and the structure of the tail fan are very similar in the two genera. Both sides of the telson in the two genera are fringed with spines; in both forms on the external margin of the exopodite there is a spine in correspondence with the diaeresis, which margin is also fringed (see Fig. 47). The two genera differ in the structure of the chelae of the first pair of pereiopods, which are stockier and stronger in *Glaessnericaris* n. gen., and for the structure of the second pair of pereiopods: while in *Platychela* it is bigger than the III-V pair, in the Norian and Rhaetian forms it is as big as those of the following pairs. Also the position of the grooves is different in the two genera: in the new genus the three grooves are all close, while in the Carnian form the cervical groove is in a more advanced posi-

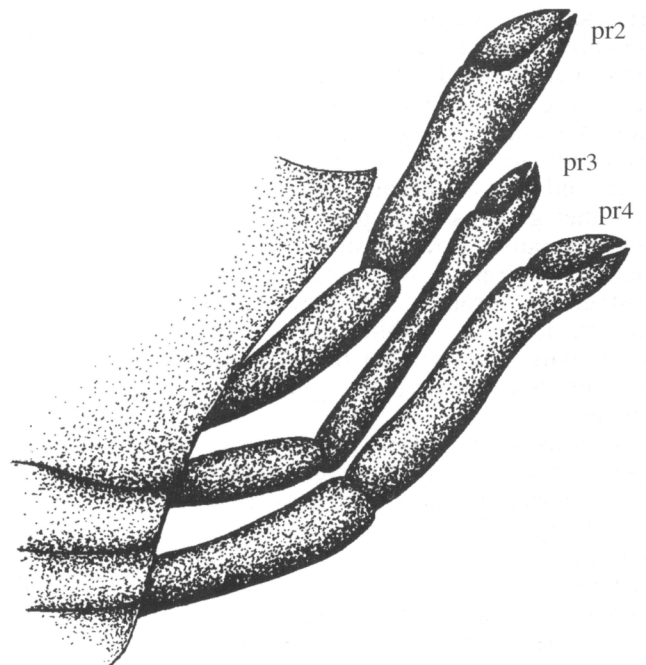


Fig. 45 - *Glaessnericaris macrochela* n. gen. n. sp., n. cat. MSNB 4202 II-IV pair of pereiopods with ornamentation, photo and reconstruction (x 4,5)

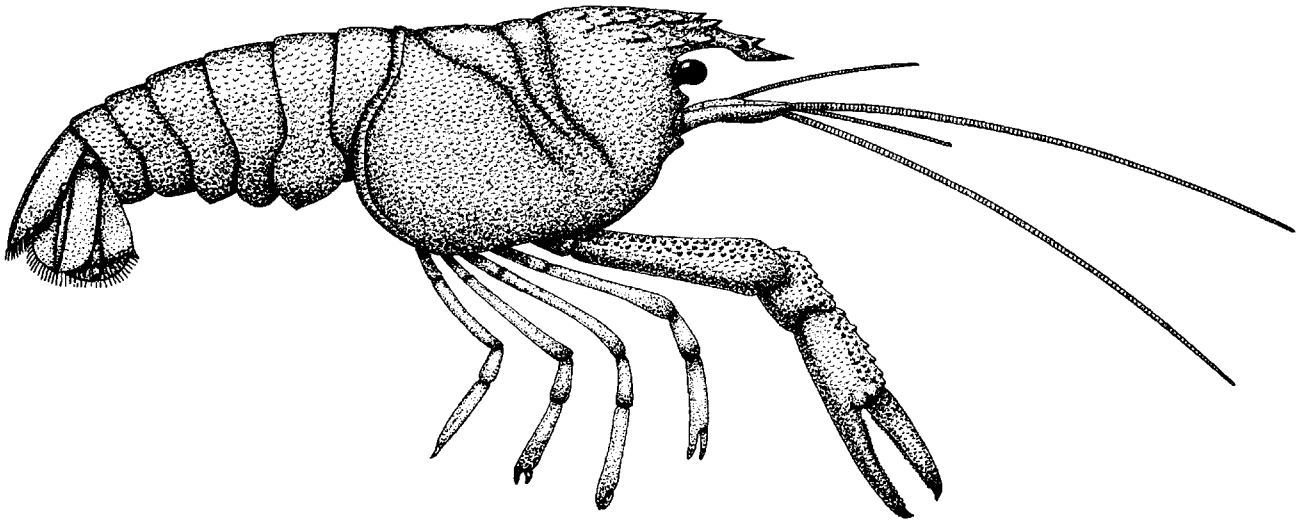


Fig. 46 - *Glaessnericaris macrochela* n. gen. n. sp., reconstruction

tion than the other two (see Fig. 48). It was not possible to ascertain with certainty the presence in *Platycheila* of a chelate IV pereiopod, since its extremity is never clearly preserved in the specimens of Carnian. It is nevertheless allowable to think that such an unusual feature does belong to the members of the family, because of the already mentioned morphological similarities.

The same characteristic of a chelate IV pair of pereiopods is shared by *Glaessnericaris* n. gen. and the forms of the superfamily Eryonoidea de Haan, 1841, even though they differ in the general shape of the body (and in particular in the laterally and not dorsoventrally compressed body in *G.*), the absence of carinae in *G.* and in the first four pairs of pereiopods, whose dactylus is internal and not external, as in eryonoids.

Also the form from the Norian of Cene described by Pinna, 1974 as *Protoclytiopsis* ? *dubia* must be ascribed to the genus *Glaessnericaris* n. gen.; *G. macrochela* n. gen. n. sp. and *G. dubia* (Pinna, 1974) share the same shape of the carapace, the trend of the grooves, the shape of the first pair of pereiopods, the general morphology of the body. By preparing a specimen of Cene (MSNB 3382, specimen represented by Pinna, 1974, Tab. XIV, fig.1), we were able to ascertain that it also has a chelate IV pereiopod. So there is no doubt that the forms of Ponte Giurino and of Cene belong to the same genus. However there are differences that justify the splitting of the forms of Ponte Giurino into a new specific entity. After the publication of Pinna the specimen MSNB 3186 (represented by Pinna, 1974, p. 27, fig. 12) has been further prepared: it was therefore possible to notice that the rostrum of *G. dubia* is actually different from the reconstruction of the author. In fact there are no subrostral teeth on the rostrum, while there are suprarostrol teeth:

at the base of the rostrum there are two (or three ?) spines, followed by an anteroventral spine and by three (or four ?) definitely more backward protuded spines. On the contrary the rostrum of *Glaessnericaris* n. gen. is longer, with two basal suprarostrol teeth, an isolated suprarostrol tooth and a subrostral middle tooth; moreover the dorsal region is ornamented on the anterior third with scattered backward protuded spines, lacking in *G. dubia* (Pinna, 1974).

The high number of specimens in our possession allows us to reconsider the generic attribution of these forms. In fact Pinna, 1974 ascribed, even with reservations, the forms of Cene to the genus *Protoclytiopsis* Birsthein, 1958. This genus is known only by a single specimen (consisting in a single carapace) from the U. Permian of Western Siberia, on which Birsthein established the species *P. antiqua*. The species was re-represented and re-described by Förster, 1967 (p. 142; fig. 3; table 9, fig. 1), who ascribed *Protoclytiopsis* to the family Erymidae Van Straelen, 1924, subfamily Eryminae Van Straelen, 1924. Beyond a certain similarity in the outline of the carapace, the trend of the grooves of *Glaessnericaris* n. gen. is definitely different from that of *Protoclytiopsis* (see Fig. 48): in fact the forms from the Upper Triassic of Southern Alps lack the gastro-orbital, the antennal and the ventral grooves, and the branchiocardiac and the postcervical grooves are not joint together or to the cervical groove; moreover the carapace of *Protoclytiopsis* is more elongated, not laterally flattened, and the grooves are not as withdrawn toward the posterior margin as in *Glaessnericaris* n. gen. Therefore these differences lead us to exclude that the forms of Upper Triassic of Southern Alps belong to the genus *Protoclytiopsis* and they justify the creation of a new generic entity.

## CONCLUSIONS

The fauna of Ponte Giurino is from a general point of view a fauna of transition between the typical faunas of Upper Triassic of Austrian Alps (Glaessner, 1931) and of Southern Alps (Pinna, 1974) from one

side, and the faunas of Lower Jurassic like that of Osteno (Arduini, Pinna & Teruzzi, 1982; Garassino & Teruzzi, 1990; Teruzzi, 1990) on the other side. The fauna of Ponte Giurino shares a few elements with the

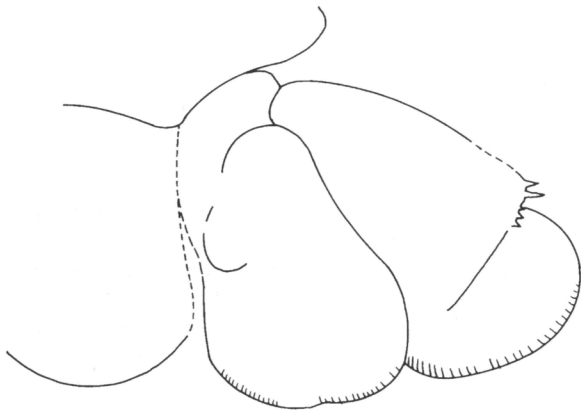
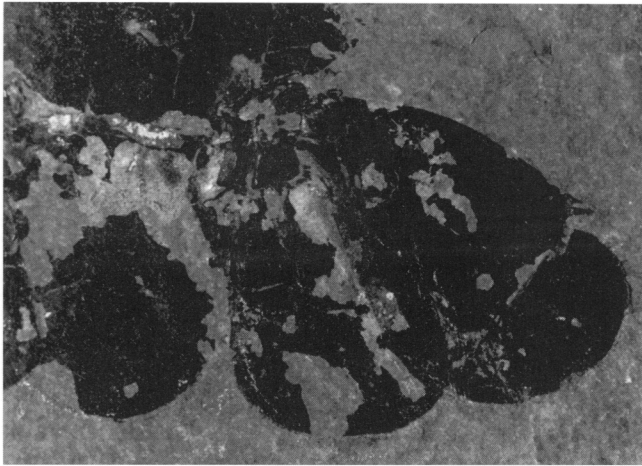
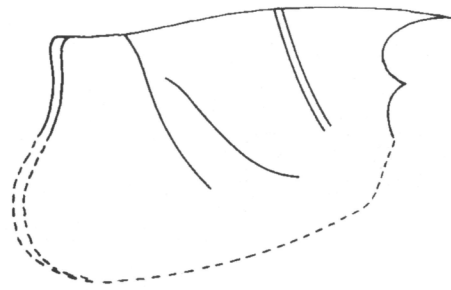


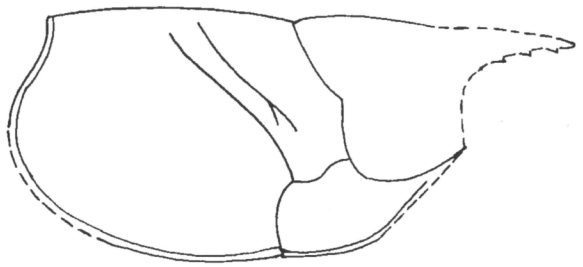
Fig. 47 - *Platycheila* Glaessner, 1933, tail fan, photo and reconstruction

Norian faunae typical of the underlying Calcare di Zorzino (Cene, Valvestino). Common elements of the two faunae at specific level are represented by *Archaeopalinurus levis* Pinna, 1974, by the single fragmentary specimen found at Ponte Giurino of *Palaeodusa longipes* Pinna, 1974 (generally rather abundant in the anoxic basins of the Calcare di Zorzino); at generic level a common element is the genus *Glaessnericaris* n. gen. n. sp., which is much more abundant at Ponte Giurino than in the Norian deposits, but with different species. Moreover the ratio between natantians and reptants is reversed in the two faunae: at Cene the natantians include 90% of the decapods, while at Ponte Giurino they are 24,5% of the decapod fauna, since the remaining 75,5% is made of reptants. Furthermore the term natantian applied to the natantians of Ponte Giurino must not be taken in its restrictive sense: the general features of the penaeids of Ponte Giurino, and especially their relatively heavy structure of pereiopods, lead us to think that they indeed lived an epibenthonic life, while *Antrimpos noricus* Pinna, 1974, predominant species among the penaeids of the deposit of Cene, has the typical shape and appendages of a nectonic form.

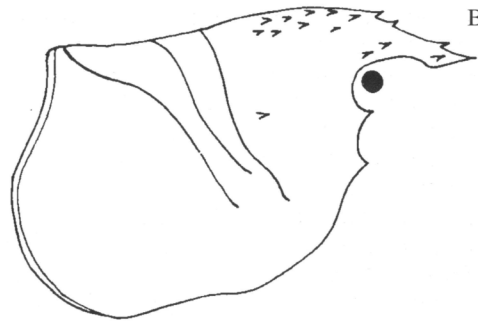
Among those families that are well represented at Ponte Giurino, and which became later widespread in the Lower Jurassic, we find the first representatives of the family Coleiidae with *Pseudocoleia* n. gen., up to now known only at Ponte Giurino, and of the Mecochiridae with the genus *Pseudoglyphea*, relatively abundant in the deposit, and already known in the Austrian Rhaetian with *P. alpina* Förster, 1971.



A



B



C

Fig. 48 - A) *Platycheila* Glaessner, 1931 (from Glaessner, 1931); B) *Protoclytiopsis antiqua* Birsthein, 1958 (from Förster, 1967); C) *Glaessnericaris macrochela* n. gen. n. sp.; carapaces

Therefore the decapod faunae of the Norian carbonatic platforms and the fauna of Ponte Giurino remarkably differ in composition and structure. We believe that such difference is not due to particular evolutionary changes that involved the decapod crustaceans during the short span of time separating these Upper Triassic faunae, but rather to the dramatic environmental changes that took place in the Lombard area between the Norian and the Rhaetian. As already cited in the beginning of this work, in the Upper Norian-Lower Rhaetian (?) a sudden passage, in terms of geological time, took place in the Lombard area: from the conditions of carbonatic platform with narrow internal basins in the Norian (group of Dolomia Principale-Limestone of Zorzino Fms.), to the condition of a deep and large basin characterized by abundant terrigenous influxes and by the end of carbonate production (Argilliti di Riva di Solto Fm.).

It is difficult to add more detailed information about

the depositional environment of the deposit of Ponte Giurino, since we presently lack precise geological, sedimentary and geochemical data. However the fauna of Ponte Giurino does not seem to be autochthonous. The fossiliferous strata are finely laminated, not bioturbated, and up to now we did not find any kind of mark that could be linked to animal activity; such marks should be present in case of autochthony of this kind of fauna, with a high number of benthonic elements,

mainly thylacocephalan and decapod crustaceans. It seems therefore evident that the organisms of Ponte Giurino, or at least the benthonic ones, were transported to the deposit after their death by currents that, though weak, had to exist in the basin of AdS. It seems also evident that, as it often happens in the formation of a lagerstätten, the existence of strongly anoxic conditions at the bottom played a leading role in the preservation of organic remains.

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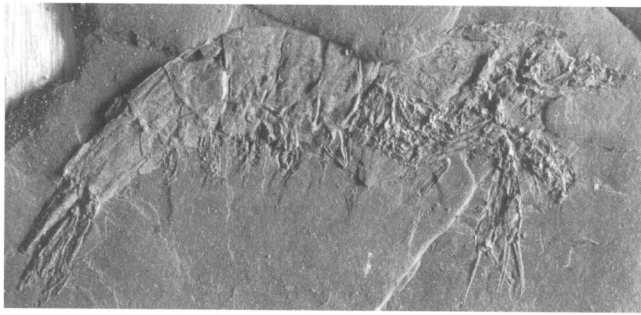
mens of *Platycheila* Glaessner, 1931, Dr. Gianbruno Grippa of Milan for the latest informations on living crustaceans; Dr. Marco Stefani of the Institute of Geology of the University of Ferrara for the informations on the sedimentology and the palaeoenvironment of carbonatic platforms of Lombardian Upper Triassic.

The reconstructions of the crustaceans are from Dr. Giorgio Chiozzi, the other drawings are from Massimo Demma. Photographs by Luciano Spezia.

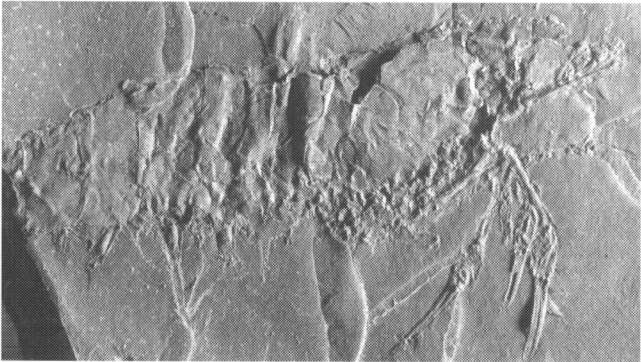
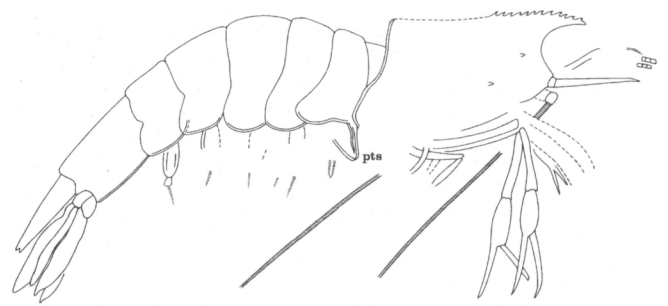
### REFERENCES

- ALESSANDRELLO A. & TERUZZI G., 1986 - *Palaeoaphrodite raetica* n. gen. n. sp., a new fossil polychaete annelid of the Rhaetic of Lombardy. *Atti Soc. ital. Sci. nat. Museo Milano*, Milano, 127:297-300
- ARDUINI P. & BRASCA A., 1984 - *Atropicaris*: nuovo genere della classe Thylacocephala. *Atti Soc. ital. Sci. nat. Museo Milano*, Milano, 125: 87-93
- ARDUINI P., 1988 - *Microraris* e *Atropicaris*: due generi della classe Thylacocephala. *Atti Soc. ital. Sci. nat. Museo Milano*, Milano, 129: 159-163
- ARDUINI P., PINNA G. & TERUZZI G., 1982 - Il giacimento sinemuriano di Osteno in Lombardia e i suoi fossili. In: Montanaro Gallitelli E. ed., *Palaeontology, Essential of Historical Geology*, Modena, 495-522
- ASSMANN P., 1927 - Die Decapodenkrebse des deutschen Muschelkalks. *Jb. Preuss. Geol. Land.*, Berlin, 48: 332-356
- BACHMAYER F., 1954 - *Palaeopalinurus glaessneri* n. gen. n. sp. aus dem Oberjura-Kalk von Stramberg in Mähren. *N. Jb. Geol. Pal. Abh.*, Stuttgart, 99: 147-152
- BILL P.C., 1914 - Ueber Crustaceen aus dem Voltziensandstein des Elsasses. *Mitt. Geol. Land. Elsass-Loth.*, Strassburg, 8: 289-338
- BIRSTHEIN J.A., 1958 - Ein Vertreter der ältesten Ordo der Crustacea Decapoda *Protoclytiopsis antiqua* gen. nov. sp. nov. aus dem Perm West-Sibiriens. *Dokl. Akad. Nauk.*, SSSR, 122: 477-480
- BRONN H.G., 1858 - Beiträge zur triasischen Fauna und Flora der bituminösen Schiefer von Raibl. *N. Jb. Min.*, Stuttgart, 1-32
- CASATI P., 1964 - Il Trias in Lombardia. Studi geologici e paleontologici. VI. Osservazioni stratigrafiche sull'Infraretico delle Prealpi Bergamasche. *Riv. It. Pal.*, Milano, 70: 447-465
- CASATI P. & GAETANI M., 1979 - The Triassic in Lombardy. In: R. Assereto and G. Pisa field symposium on Triassic Stratigraphy in Southern Alps, *Field Guide-Book*, Milano, 73
- FÖRSTER R., 1966 - Über die Erymiden, eine alte konservative Familie der Mesozoischen Dekapoden. *Palaeontographica Abt. A.*, Stuttgart, 125: 61-175
- FÖRSTER R., 1967 - Die reptanten Dekapoden der Trias. *N. Jb. Geol. Paläont. Abh.*, Stuttgart, 128: 136-194
- FÖRSTER R., 1971 - Die Mecochiridae, eine spezialisierte Familie der mesozoischen Glypheoidea (Crustacea, Decapoda). *N. Jb. Geol. Paläont. Abh.*, Stuttgart, 137: 396-421
- FÖRSTER R., 1973 - Untersuchungen an oberjurassischen Palinuridae (Crustacea, Decapoda). *Mitt. Bayer. Staatssmmil Paläont. hist. Geol.*, München, 13: 31-46
- FÖRSTER R., 1973 - Krebse aus der Trias von Oberfranken. *Geol. Bl. NO-Bayern*, Erlangen, 23: 96-101
- GALL J.C., 1971 - Faunes et Paysages du Grès à Voltzia du Nord des Vosges. Essai Paléocécologique sur le Buntsandstein Supérieur. *Mém. Serv. Carte géol. Als. Lorr.*, Strassburg, 34: 1-318
- GARASSINO A. & TERUZZI G., 1990 - The genus *Aeger* Münster, 1839 in the Sinemurian of Osteno in Lombardy (Crustacea, Decapoda). *Atti Soc. ital. Sci. nat. Museo Milano*, Milano, 131, (5): 105-136
- GLAESSNER M.F., 1930 - Dekapodenstudien. I. Die Dekapodenfauna vom Raibl. *N. Jh. Min. Geol. Pal.*, Stuttgart, 63: 137-176
- GLAESSNER M.F., 1931 - Eine Crustaceenfauna aus den Lunzer Schichten Niederösterreichs. *Jh. Geol. Bund.*, Wien, 81: 467-486
- GLAESSNER M.F., 1965 - Vorkommen fossilen Dekapoden (Crustacea) in Fisch-Schiefern. *Senck-Leth.*, Frankfurt am Main, 46a: 111-122
- GLAESSNER M.F., 1969 - Crustacea Decapoda. In Moore R.C., *Treatise on Invertebrate Paleontology*. (R) Arthropoda 4 (2), Lawrence, R399-R533
- GNACCOLINI M., 1965 - Il Trias in Lombardia. Studi geologici e paleontologici. XV. Calcarea di Zu e Argilliti di Riva di Soltò: due formazioni del Retico Lombardo. *Riv. It. Pal.*, Milano, 71:1099-1121
- HOLTHUIS L.B., 1955 - The recent genera of the Caridean and Stenopodidean shrimps (Class Crustacea, Order Decapoda, Supersection Natantia) with keys for their determination. *Z. Ver.*, Leiden, 26-31: 1-157
- JADOUJ F., 1986 - Stratigrafia e paleogeografia del Norico delle Prealpi Bergamasche Occidentali. *Riv. It. Pal. Strat.*, Milano, 91:479-512
- MÜNSTER G., 1839 - Abbildungen und Beschreibung der foss. krebse i. d. Kalkschiefern von Bayern. *Beitr. Z. Petr.*, Bayreuth, 1
- OPPEL A., 1862 - Palaeontologische Mittheilungen aus dem Museum des Koenigl. Bayer. Staat., Stuttgart, 288
- PINNA G., 1968 - Gli crionidei della nuova fauna sinemuriana a crostacei decapodi di Osteno in Lombardia. *Atti Soc. Ital. Sci. nat. Museo Milano*, Milano, 107, (2): 93-134
- PINNA G., 1969 - Due nuovi esemplari di *Coleia vialii* Pinna, 1968 del Sinemuriano inferiore di Osteno in Lombardia (Crustacea Decapoda). *Ann. Museo Civ. St. Nat. Genova*, Genova, 77: 626-632
- PINNA G., 1974 - I Crostacei della fauna triassica di Cene in Val Seriana (Bergamo). *Mem. Soc. It. Sc. Nat.*, Milano, XXI, 1
- PINNA G., 1976 - I Crostacei triassici dell'Alta Valvestino (Brescia). "*Natura Bresciana*" *Ann. Mus. Civ. St. Nat.*, Brescia, 13: 33-42
- SCHRAM F.R., 1980 - Miscellaneous late paleozoic malacostraca of the Soviet Union. *Journal of Paleontology*, San Diego, 54, (3): 542-547
- STEFANI M., ARDUINI P., GARASSINO A., PINNA G., TERUZZI G. &

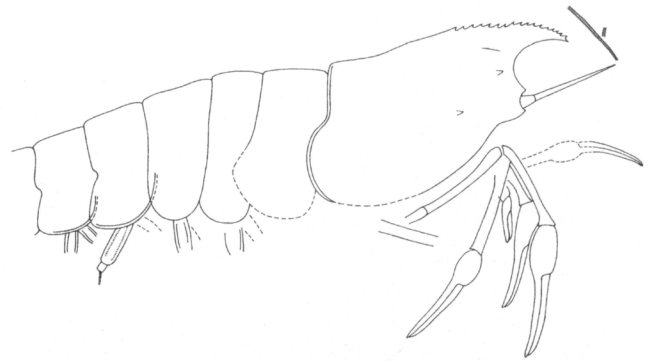
- TROMBETTA G. L., 1992 - Palaeoenvironment of extraordinary fossil biotas from the Upper Triassic of Italy. *Atti Soc. ital. Sci. nat. Museo Milano*, Milano 132, (24): 309-335
- TERUZZI G., 1990 - The genus *Coleia* Broderip, 1835 (Crustacea, Decapoda) in the Sinemurian of Osteno in Lombardy. *Atti Soc. ital. Sci. nat. Museo Milano*, Milano, 131, (4): 85-104
- TINTORI A., 1980 - Teeth of the Selachian genus *Pseudodalatias* (Sykes, 1971) from the Norian (Upper Triassic) of Lombardy. *Riv. It. Paleont.*, Milano, 86, (1): 19-30
- TINTORI A., MUSCIO G. & NARDON S., 1985 - The Triassic fossil fishes localities in Italy. *Riv. It. Paleont. Strat.*, Milano, 91, (2): 197-210
- VAN STRAELEN V., 1923 - Description de Crustacés Décapodes macroures nouveaux des terrains secondaires. *Ann. Soc. R. Zool. Belg.*, Bruxelles, 53: 84-93
- VAN STRAELEN V., 1925 - Contribution a l'étude des Crustacés Décapodes de la période Jurassique. *Mem. Acad. R. Belg.*, 7
- VAN STRAELEN V., 1936 - Sur des Crustacés Décapodes triasiques du Nevada. *Bull. Mus. R. Hist. Nat. Belg.*, Bruxelles, 12, (29): 1-7
- VAN STRAELEN V., 1940 - Pénéides nouveaux méso-et cénozoïques. *Bull. Mus. R. Hist. Nat. Belg.*, Bruxelles, 11: 159-162
- VISSCHER H., 1983 - I.G.C.P. Project n. 4: a major achievement in Triassic research. A challenge to the S.T.S., *Albertiana*, Utrecht, 1: 3-6
- WHALLEY P., 1986 - Insects from the Italian Upper Trias. *Riv. Mus. civ. Sc. Nat. "E. Caffi"*, Bergamo, 10: 51-60
- ZAMBELLI R., 1980 - Note sui Pholidophoriformes. III. *Pholidophorus gervasuttii* sp.n.. *Riv. Mus. civ. Sc. Nat. "E. Caffi"*, Bergamo, 1: 5-37
- ZAMBELLI R., 1986 - Note sui Pholidophoriformes. VI. Pholidophorinae subfamiglia nuova del Triassico superiore. *Riv. Mus. civ. Sc. nat. "E. Caffi"*, Bergamo, 10: 1-32



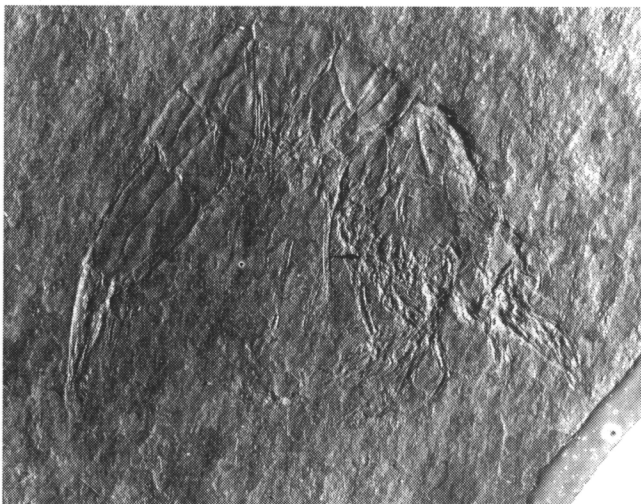
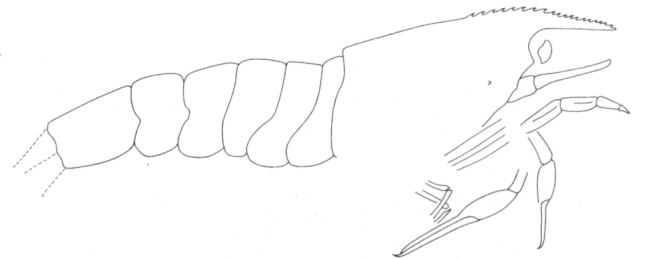
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Table I - 1) *Longichela orobica* n. gen. n. sp., holotype, n. cat. MSNM i10738, photo and reconstruction (x 2); 2) *Longichela orobica* n. gen. n. sp., n. cat. MSNM i10739, photo and reconstruction (x 1,8); 3) Cfr. *Longichela orobica* n. gen. n. sp., n. cat. MSNB 8200, photo and reconstruction (x 1,2); 4) *Satyrus cristatus* n. gen. n. sp., holotype, n. cat. MSNB 8190, photo and reconstruction (x 3,2)