

Position in the system and the origin of deep-water chitons of the family **Ferreiraellidae (Mollusca: Polyplacophora)**

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A study of paratype of *Xylochiton xylophagus* Gowlett-Holmes et Jones, 1992 and a comparison with species of the genus *Ferreiraella* prove that this species belongs to the latter genus. The position of the family Ferreiraellidae Dell'Angelo et Palazzi, 1991 in the system of Polyplacophora and the validity of this name are discussed. It is proposed to regard names Abysochitonidae Dell'Angelo et Palazzi, 1989 and Xylochitonidae Gowlett-Holmes et Jones, 1992 as junior synonyms of Ferreiraellidae, because the name *Abysochiton* Dell'Angelo et Palazzi, 1989 is a junior synonym of *Ferreiraella* Sirenko, 1988 (based on the same species), and the invalidity of the name *Abysochiton* was recognized by its authors in the same publication. A revised diagnosis of the family Ferreiraellidae is given. Based on comparison of morphological and ecological features, a supposition is made about close relationship between *Ferreiraella* and *Glaphurochiton*, species of which in the Upper Carboniferous inhabited shallow waters of south-eastern part of present North America. Probably the genus *Ferreiraella* originated from one of representatives of the genus *Glaphurochiton* that in the Upper Carboniferous apparently inhabited sunken plant remains and fed on them, since plates of its shell were found in dark grey shales. The first *Ferreiraella* species that originated in the Upper Carboniferous was possibly *F. caribbensis*, now living in the Caribbean Sea or species closely related to it. Later the representatives of *Ferreiraella* spread with waters of the Paleotethys westwards to the region of present California and Panama Bay and eastwards to the region of present Japan, Indonesia and New Zealand. The supercontinent Pangea that was formed in the Permian divided the common distribution range of the genus *Ferreiraella* into two parts. In the Jurassic, the Pangea began to split into blocks, and marine organisms inhabiting shelf and slope of these blocks moved with them. Since then chitons *Ferreiraella* remained in the region of the former supercontinent Pangea only in those areas where sunken wood was accumulated.

Положение в системе и происхождение панцирных моллюсков глубоководного семейства Ferreiraellidae (Mollusca: Polyplacophora)

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Изучение паратипа *Xylochiton xylophagus* Gowlett-Holmes et Jones, 1992 и сравнение его с видами рода *Ferreiraella* доказывает принадлежность этого вида роду *Ferreiraella*. Обсуждено положение в системе Polyplacophora семейства Ferreiraellidae Dell'Angelo et Palazzi, 1991 и валидность этого наз-

вания. Предложено считать младшими его синонимами названия *Abyssochitonidae* Dell'Angelo et Palazzi, 1989 и *Xylochitonidae* Gowlett-Holmes et Jones, 1992, потому что название *Abyssochiton* Dell'Angelo et Palazzi, 1989 является младшим синонимом *Ferreiraella* Sirenko, 1988 (основано на том же виде) и невалидность названия *Abyssochiton* была признана его авторами в той же публикации. Приводится переработанный диагноз семейства *Ferreiraellidae*. На основании сравнения морфологических и экологических черт сделано предположение о близком родстве *Ferreiraella* и рода *Glaphurochiton*, виды которого обитали в верхнем карбоне в мелководном море, располагавшемся в юго-восточной части нынешней Северной Америки. Вероятно, род *Ferreiraella* произошел от одного из представителей рода *Glaphurochiton*, который уже в верхнем карбоне, по-видимому, обитал на затонувших растительных остатках и питался ими, так как пластинки его раковины найдены в темно-серых сланцах. Первым видом *Ferreiraella*, который произошел в верхнем карбоне, был, возможно, *F. caribbensis*, обитающий сейчас в Карибском море, или близкий к нему вид. Позже, используя воды океана Палеотетис, первые представители *Ferreiraella* распространились на запад в районы нынешней Калифорнии и Панамского залива и на восток в район нынешней Японии, Индонезии и Новой Зеландии. Суперконтинент Пангея, который сформировался в перми, разделил прежде единый ареал рода *Ferreiraella* на 2 части. В юре Пангея стала распадаться на блоки, и морские организмы, которые обитали на шельфе и склоне этих блоков, перемещались вместе с ними. С тех пор хитоны *Ferreiraella* остались обитать на краях бывшего суперконтинента Пангея лишь в тех участках, где накапливается затонувшая древесина, служащая моллюскам как субстратом, так и пищей.

INTRODUCTION

In recent years a number of monographs on chitons were published [Kaas, Van Belle, 1985a, 1998b, 1987, 1990, 1994], which increased the interest in systematics of chitons. Primarily this was interest in the most primitive Recent chitons of the order *Lepidopleurida* [Sirenko, 1988, 1992, 1996; Dell'Angelo, Palazzi, 1989, 1991, Gowlett-Holmes, Jones, 1992; Jones, Gowlett-Holmes, 1992].

The latter publications contain propositions that are controversial in our opinion. Critical remarks on these propositions became one of the reasons for writing the present paper. The other reason was old elaboration of hypothesis on the origin of the family *Ferreiraellidae* and its relations to other known chiton families. Schemes of reconstructions of location of continents and oceans prepared by Zonenshain et al. [1984] are used in the paper.

List of abbreviations

LASM — Natural History Museum, Los Angeles County;

MNHN — Muséum national d'Histoire naturelle, Paris;

CASI — California Academy of Sciences, Department of Invertebrate Zoology, San Francisco;

SIO — Scripps Institute of Oceanography, La Jolla, California;

ZISP — Zoological Institute, Russian Academy of Sciences, St.-Petersburg.

MATERIAL AND METHODS

Material used in the work is deposited in collections of the Zoological Institute: *Ferreiraella caribbensis* Sirenko, 1988 (holotype and 24 paratypes), *F. takii* (Wu et Okutani, 1984) (South China Sea, 2 spms), *F. scrippsiana* (Ferreira, 1980) (Gulf of Panama, 1 spm), and *Xylochiton xylophagus* Gowlett-Holmes et Jones, 1992 (one paratype). Also material on *Ferreiraella plana* (Nierstrasz, 1905) (Vanuatu, 3 spms, New Caledonia, 2 spms), and *Ferreiraella sp.* (Vanuatu, 81 spms) provided by Dr. P. Bouchet (MNHN) has been used. Besides, I have used data on *F. scrippsiana* and *F. bartletti* Ferreira, 1986 deposited in Californian museums (CASI, LASM, SIO) and literature on species of the genera *Ferreiraella* and *Xylochiton*. Valve preparations were made for examination under the scanning electron microscope (SEM). Valves were cleaned with 7% KOH solution.

To reveal the cause of origin of disjunctive distribution range of *Ferreiraella* and also to clarify the origin and distribution of species of this genus, a method was used of plotting of ranges of fossil and Recent species from closely related genera on global geodynamic maps. Application of this method in studying the development of freshwater ostracods of the Paleozoic and Mesozoic [Neustrueva,