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Lower Devonian vertebrates, arthropods and brachiopods from northern Vietnam

Vertébrés, Arthropodes et Brachiopodes du Dévonien inférieur du nord du Viêt Nam

Patrick R. Racheboeuf [a], Philippe Janvier [b,c,*], Ta Hoa Phuong [d], Jean Vannier [e], Wang Shang-Qi [f]

[a] *UMR 6538 du CNRS, Laboratoire de Paléontologie, Université de Bretagne Occidentale, Avenue Le Gorgeu, BP 809, 29285 Brest cedex, France*
[b] *UMR 5143 du CNRS, Laboratoire de Paléontologie, Muséum National d'Histoire Naturelle, 8, rue Buffon, 75005 Paris, France*
[c] *Department of Palaeontology, The Natural History Museum, Cromwell Road, London SW7 5BD, Grande-Bretagne, UK*
[d] *Department of Geology, Vietnam National University at Hanoi, 334, Nguyên Trai Road, Thanh Xuan, Hanoi, Vietnam*
[e] *UMR 5125 du CNRS, Paléoenvironnements et Paléobiosphère, Université Claude Bernard Lyon-1, Bâtiment Geode, 2, rue Raphaël Dubois, 69622 Villeurbanne cedex, France*
[f] *Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, East Beijing Road 39, Nanjing 210008, China*

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Abstract

Additional vertebrates and ostracods from the bituminous shale of the Khao Loc Formation at Tong Vai, Ha Giang Province, northern Vietnam, corroborate its correlation with the upper part of the Xishancun (Xiaxishancun) Formation and the lower part of the Xitun and Lianhuashan formations of South China, and its Middle to Late Lochkovian age. The variations in morphology and ornamentation of the galeaspid *Polybranchiaspis liaojaoshanensis* from Tong Vai are discussed and regarded as possibly size and growth-related. A new acanthothoracid placoderm with a very deep dorsal process is described from Tong Vai and the specific distinction between the antiarchs *Minicrania lissa* from Tong Vai and *M. lirouyii* from Yunnan is supported by additional characters. Petalichthyid placoderms are recorded from this locality for the first time, and the skull of a juvenile youngolepidid sarcopterygian is described. Eurypterid fragments and a phyllocarid crustacean are also recorded from the Khao Loc Formation. A new species of the chonetid brachiopod genus *Tulynetes*, endemic to northern Vietnam, is described from the Pragian Mia Le Formation at Cu Le, Bac Kan Province, a new locality which yields a large diversity of taxa with outstanding preservation.

Résumé

De nouveaux vertébrés et des ostracodes des schistes bitumineux de la Formation de Khao Lôc à Tong Vài, Province de Hà Giang, nord du Viêt Nam, corroborent la corrélation de cette formation avec la partie supérieure de la Formation de Xishancun (Xiashishancun) et la partie inférieure des formations de Xitun et de Lianhuashan de la Chine du Sud et permettent de lui attribuer un âge Lochkovien moyen à tardif. Les variations de la morphologie et de l'ornementation du galéaspide *Polybranchiaspis liaojaoshanensis* de Tong Vài sont considérées comme peut-être liées à la croissance. Un nouveau placoderme acanthothoracide, présentant un processus dorsal très élevé, est décrit à Tong Vài et la différence spécifique entre les antiarches *Minicrania lissa* de Tong Vài et *M. lirouyii* du Yunnan est confirmée sur la base de nouvelles observations. Des placodermes pétalichthyides sont signalés pour la première fois dans ce gisement et le crâne d'un sarcoptérygien youngolépididé est décrit. Des fragments d'euryptérides et un phyllocaride sont également signalés dans la Formation de Khao Lôc. Une nouvelle

* Corresponding author.
E-mail address: janvier@mnhn.fr (P. Janvier).

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espèce de brachiopode chonétoïde du genre *Tulynetes*, endémique au nord du Viêt Nam, est décrite de la Formation de Mia Lé, d'âge praguien, dans le gisement de Cu Lé, qui a livré de nombreux invertébrés en excellent état de conservation.

Keywords: Lower Devonian; Biostratigraphy; Brachiopoda; Vertebrata; Ostracoda; Eurypterida; Phyllocarida; Vietnam

Mots clés : Dévonien inférieur ; Biostratigraphie ; Brachiopoda ; Vertebrata ; Ostracoda ; Eurypterida ; Phyllocarida ; Viêt Nam

1. Introduction

The new material described herein was collected in 2000 during a field expedition to Bac Bo (northern Vietnam), in which four of us (P.J., P.R., T. H.P and Professor Tong-Dzuy Thanh, Hanoi) took part. A section of the present article is a review of the vertebrate fauna of the Lochkovian Khao Loc Formation at Tong Vai (Ha Giang province), which supplements the descriptions provided in Tong-Dzuy et al. (1995a); Janvier and Ta Hoa (1999), notably with the description of a new acanthothoracid placoderm. The associated invertebrate fauna, in particular ostracods, provides additional biostratigraphical data. There remains, however, a minor discrepancy between the vertebrate and ostracod data, as to the correlation of the lower member of the Khao Loc Formation with either the upper part of the Xishancun Formation (for which the correct spelling should be Xiaxishancun Formation; yet the name Xishancun is now widely used in the literature), or the lower part of the Xitun Formation of the Cuifengshan Group of Yunnan, and the lower part of the Lianhuashan Formation of Guangxi.

The additional description of a new species of the strophochonetid brachiopod genus *Tulynetes* from Cu Le (Bac Kan Province) follows the review by Racheboeuf and Tong-Dzuy (2000), in the framework of a detailed survey of the invertebrate fauna of the Pragian Mia Le Formation.

The material described herein belongs to the collection of the Geological Museum (suffix BT, for Bao Tang Dia chat), Geological Survey of Vietnam, 6 Pham Ngu Lao, Hanoi.

Taxonomic disclaimer: The authorship of the new taxa erected in this paper is P. Janvier for the vertebrates and P. Racheboeuf for the brachiopods.

2. The vertebrates, ostracods and eurypterids of the Khao Loc Formation, Tong Vai, Ha Giang Province

The Early Devonian vertebrate locality of Tong Vai (23°11′N, 105°6′E) was first recorded by Tong-Dzuy et al. (1995a) (see this reference for locality map and details of the geological context). Additional data about its vertebrate fauna was later published by Janvier and Ta Hoa (1999). Field work in 2000 has provided complementary vertebrate material from this locality, in association with ostracods, a few poorly preserved and stratigraphically uninformative rhynchonellid brachiopods, a phyllocarid crustacean, and some eurypterid exoskeletal fragments, all found in the oil-bearing shale and fine-grained sandstone of the lower member of the Kao Loc Formation. To date, the invertebrate fauna recorded by Tong-Dzuy (in Dang Vu et al., 2000) from the lower member of the Khao Loc Formation consists of brachiopods [*Howittia wangi* (Hou, 1959), *Tadschikia* aff. *T. xuanbaoi* Zuong et al., 1968 and *Howellella* ex. gr. *H. crispa* (Hisinger, 1826)], and ostracods (see also below). The limestone beds of its upper member yield tabulate corals [*Squameofavosites vanchieni* Tong-Dzuy, 1967, *S. spongiosus* Dubatolov, 1963, *S. baolacensis* Tong-Dzuy, 1967, *S. obliquespinus* (Tchernychev, 1951), *Favosites kolimaensis* Rukhin, 1938, *F. stellaris* Tchernychev, 1937, *Parastriatopora champungensis* Tong-Dzuy (in Dubatolov and Tong-Dzuy, 1965), and *Thamnopora beliakovi* Dubatolov, 1956]. The uppermost part of this member yields ramiform stromatoporoids and some tabulate corals [*Striatopora* sp., *Thamnopora kolodaensis* Dubatolov, 1959, *T.* cf. *T. siavis* Dubatolov et al., 1959, *Alveolitella* cf. *A. polenowi* (Peets, 1901), and *Corolites haoi* Nguyên and Nguyên Huu, 1980]. The age first suggested by this faunal assemblage was Pragian to Givetian, yet Ta Hoa et al. (1996) and Tong-Dzuy (in Dang Vu et al., 2000) regarded this stratigraphical assignment with reservations. The Khao Loc Formation is underlain by the limestone of the Ban Thang Formation, which has yielded scolecodonts (?*Staurocephalites* sp., ?*Anisocerasites* sp.) and some specimens of *Amphipora* sp. (Ta Hoa and Le Van, 1996; Ta Hoa et al., 1996).

Janvier and Ta Hoa (1999) pointed out that the vertebrate fauna of the Khao Loc Formation is almost point-for-point similar to that of the Xishancun Formation of the Cuifengshan Group of the Qujing area in Yunnan, which has been referred to the Lochkovian (or its Chinese equivalent the Lianhuashanian) by Yang et al. (1981), an age which has never been questioned to date (Zhu, 2000; Zhu et al., 2000). However, according to Fang et al. (1994) and Wang's (1996) review of the Sinoleperditiinae, the lower part of the Lianhuashan Formation of Guangxi could be correlated with the lower or middle part of the Xitun Formation of Yunnan, which is regarded as Middle–Late Lochkovian to Early Pragian in age, on the basis of sinoleperditiine assemblages. In a preliminary survey of the ostracod fauna from the Lower Devonian of the Qujing area, Fang et al. (1985) pointed out that all the formations of the Cuifengshan Group practically yield no invertebrates. Apart from the vertebrates, only the ostracods *Leperditia* sp. and *Beyrichia* (*Beyrichia*) *xicunensis* Jiang, 1983, and the bivalves Dysodonta deprati (Mansuy, 1913), D. levis (Guo, 1980) and Modiolopsis yunnanensis (Guo, 1985) were