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Cardiolinka bohemica (Barrande, 1881) – A first representative of the Late Silurian Bohemian type Bivalvia fauna from the northern Arabian Plate, Southeast Turkey

Cardiolinka bohemica *(Barrande, 1881) – Un premier représentant de la faune de bivalves de type bohémien du Silurien supérieur en provenance de la plaque Arabique nord, Sud-Est de la Turquie*

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ABSTRACT

The Rheic Ocean was a major oceanic domain between Baltica, Laurentia, Perunica and Gondwana in Ordovician-Silurian times. The cosmopolitan nepiomorphian bivalves Praecardioidei Newell, 1965 and Antipleuroidei Kříž, 2007 are characteristic of the Silurian of Perunica, peri-Gondwana, and Baltica, and occur also in Laurentia and Siberia. The Bohemian-type bivalve *Cardiolinka* Kříž, 1981 (Nepiomorphia Kříž, 2007, Cardiolidae Hoernes, 1884), from the Late Silurian of the Bahar-1 well core, has been found for the first time in southeastern Turkey. The strata containing the species *Cardiolinka bohemica* (Barrande, 1881) occur in the middle part of the Dadaş Formation in the interior Petroleum District X-Siirt of the northern parts of the Arabian Plate. The cosmopolitan species *C. bohemica* was until now known from the Latest Ludlow to Pridoli of the Prague Basin, France, Carnic Alps, Sardinia, East European Platform (Poland), eastern Serbia, Moesian Platform, and Arctic Canada. The new surprising subsurface data on *C. bohemica* in Diyarbakır-Bismil area (southeastern Turkey) therefore represent another piece of evidence in favour of strong faunistic affinity between Perunica, peri-Gondwanan Europe and the northern Gondwana margin.

Mots clés :
Silurien
Dadaş Formation
Cardiolidae
Gondwana Nord

RÉSUMÉ

Pendant les temps Ordovicien-Silurien, l'océan Rhéïque a été un domaine océanique majeur entre Baltica, Laurentia, Perunica et Gondwana. Les bivalves cosmopolites népiomorphiens Praecardiodiei Newell, 1965 et Antipleuroidei Kříž, 2007 sont caractéristiques, pour le Silurien, des domaines Perunica, péri-Gondwana et Baltica, et sont identifiés également en Laurentie et Sibérie. Le bivalve de type bohémien *Cardiolinka* Kříž, 1981 (Nepiomorpha Kříž, 2007, Cardiolidae Hoernes, 1884) du Silurien supérieur de la carotte de forage Bahar-1 a été découvert pour la première fois dans le Sud-Est de la Turquie. Les lits contenant l'espèce *Cardiolinka bohemica* (Barrande, 1881) se trouvent dans la partie moyenne de la Formation Dadaş, au sein du district pétrolier X-Siirt dans les parties nord de la plaque Arabique. Jusqu'à présent, l'espèce cosmopolite *C. bohemica* n'était connue que

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dans la période fini-Ludlow–Pridoli du bassin de Prague, en France, dans les Alpes carniennes, en Sardaigne, dans la plate-forme est-européenne (Pologne), en Serbie orientale, dans la plate-forme Moesienne, dans la partie arctique du Canada. C'est pourquoi les résultats étonnants de subsurface, obtenus sur *C. bohemica* dans la région de Diyarbakir-Bismil (Sud-Est de la Turquie) représenteraient une nouvelle preuve en faveur d'une forte affinité faunistique entre les domaines Perunica, Europe péri-gondwanienne et la marge nord du Gondwana.

1. Introduction

Bivalves, together with cephalopods, brachiopods, trilobites, conodonts and palynomorphs, represent the most typical Silurian biota throughout the coasts of the Rheic Ocean. A rich Silurian Bivalvia fauna in the Prague Basin, Montagne Noire, Mouthoumet Massif, Carnic Alps and Sardinia consisting of several hundreds of taxa has been known and systematically studied by Jiří Kříž for 50 years (e.g. Kříž, 1965, 1979, 1996, 1999a, 1999b, 1999c, 2007, 2008; Kříž and Serpagli, 1993), with additional investigations in Bolivia (Dalenz-Farjat, 2005; Pojeta et al., 1976), Argentina (Sánchez, 1989), Russia (Bogolepova and Kříž, 1995; Kříž and Bogolepova, 1995), China (Zhang, 1984), Vietnam (Tong-Dzuy et al., 2001), North America (Pojeta et al., 1976) and Arctic Canada (Pojeta and Norford, 1987). From Turkey only a single Silurian pterineid bivalve species *Cheiopteria bridgei* Pojeta and Kříž, 1976 is known from the Halevikdere section-well data, eastern Taurides-Anatolian microplate (Fig. 1).

Lower Paleozoic sedimentary rocks are fairly widely represented in Turkey. Many of the formations crop out in the central and eastern parts of the Taurus Range belonging to the Anatolian microplate. Other outcrops are situated in southeastern Turkey, in the Border Folds where Lower Paleozoic strata are also known in the subsurface (Fig. 1). The Border Folds region is regarded as the northern part of the Arabian plate (Göncüoğlu and Kozlu, 2000). Macrofaunas (trilobites, eurypterids, brachiopods, graptolites) have been described from the outcrops (Dean and Monod, 1990; Lamsdell et al., 2013).

The Paleozoic sediments of the southeastern Anatolia can be divided into two parts: Pre-Cambrian and Cambrian sediments deposited on the stable platform, and Ordovician-Permian sediments deposited in the unstable basins. Paleozoic rocks, which are prominent at the outcrops in the Amanos Mountains, Hazro, Bedinan and Çukurca areas occur in considerable thickness in the subsurface of the region (Kellog, 1960). The Silurian and the Lower-Middle Devonian Diyarbakır Group is missing in the whole of Southeast Anatolia except Diyarbakır-Hazro and the eastern parts of the Mardin-Derik areas (Bozdoğan et al., 1987). In southeastern Anatolia, the Rhuddanian is a period of non-deposition or erosion. Thick sandstone-shale alternations of Aeronian-Telychian were only penetrated by wells in the Nusaybin area (Telhasan-1 well) and northern Syria (Fig. 1) (Bozdoğan et al., 1987). In a small inlayer in the Diyarbakır-Hazro area, blue-grey shales and marls with sandy limestones of Homerian-Lochkovian age (upper Dadaş 2 and Dadaş 3 members) have been reported (Fig. 2) (Bozdoğan and Ertuğ, 1997; Fontaine et al., 1980).

Progress made during the last 30 years in understanding Silurian paleogeography has resulted from the integration of tectonic, stratigraphic, paleomagnetic and paleontological evidence (e.g. Cocks and Fortey, 1982; Cocks and Torsvik, 2002; Ferretti et al., 2009; Havlíček, 1999; Robardet, 2003). The paleogeographical maps of Pojeta et al. (1976) have been used to plot the distributions of many fossil groups, including bivalves (e.g. Kříž, 1999b; Kříž et al., 2003). The new subsurface record, from rare extremes of the former Rheic Ocean, increases the paleobiogeographic significance of this Silurian bivalve genus.

2. Geological Setting

Southeast Anatolia represents the northern margin of the Arabian Plate, located in the southern hemisphere as a part of the Gondwanaland during the Palaeozoic (Göncüoğlu and Kozlu, 2000). However, well-dated Lower Silurian rocks (Tanf Formation), represented by an alternation of organic rich shale and sandstone, have been described only from one location (Nusaybin area) (Bozdoğan and Ertuğ, 1997; Bozdoğan et al., 1987). A regional depositional break during the Early Silurian is followed by Late Silurian deposits (Dadaş Formation), which are restricted to the central and northern parts of Southeast Anatolia (Diyarbakir Basin). Deposition of the Dadaş Formation, which consists of predominantly organic rich shale, sandstone, limestone and dolomite of restricted marine environment, is completed by a regressive cycle during the Early Devonian (Bozdoğan et al., 1987; Yılmaz and Duran, 1997).

Well-preserved and diverse palynomorphs, including acritarchs and chitinozoans belonging to the Tanf and Dadaş formations have been recovered from some wells (Erkmen and Bozdoğan, 1979; Steemans et al., 1996). Sixty acritarch species belonging to thirty-three genera and eight chitinozoan species belonging to seven genera have been identified. Late Llandovery-Early Wenlock samples are characterized by the presence of the acritarch species *Domasia bispinosa*, *Dateriocradus monterosae* and *Carminella maplowoodensis* and Ludlow-Přídoli samples are characterized by the presence of *Hapsidopalla spongiosa*, *Cymbosphaeridium pilar* and *Leonella carminae* acritarch species and *Calpichitina corinnae* chitinozoan species (Bozdoğan et al., 1987; Ertuğ et al., 1998).

Within the Dadaş Formation (Fig. 2), three members are distinguished based on different lithological compositions, which are reflected in log characteristics (Bozdoğan et al., 1987). The Dadaş 1 Member consists of dark, organic-rich shales with some limestone interbeds; the Dadaş 2

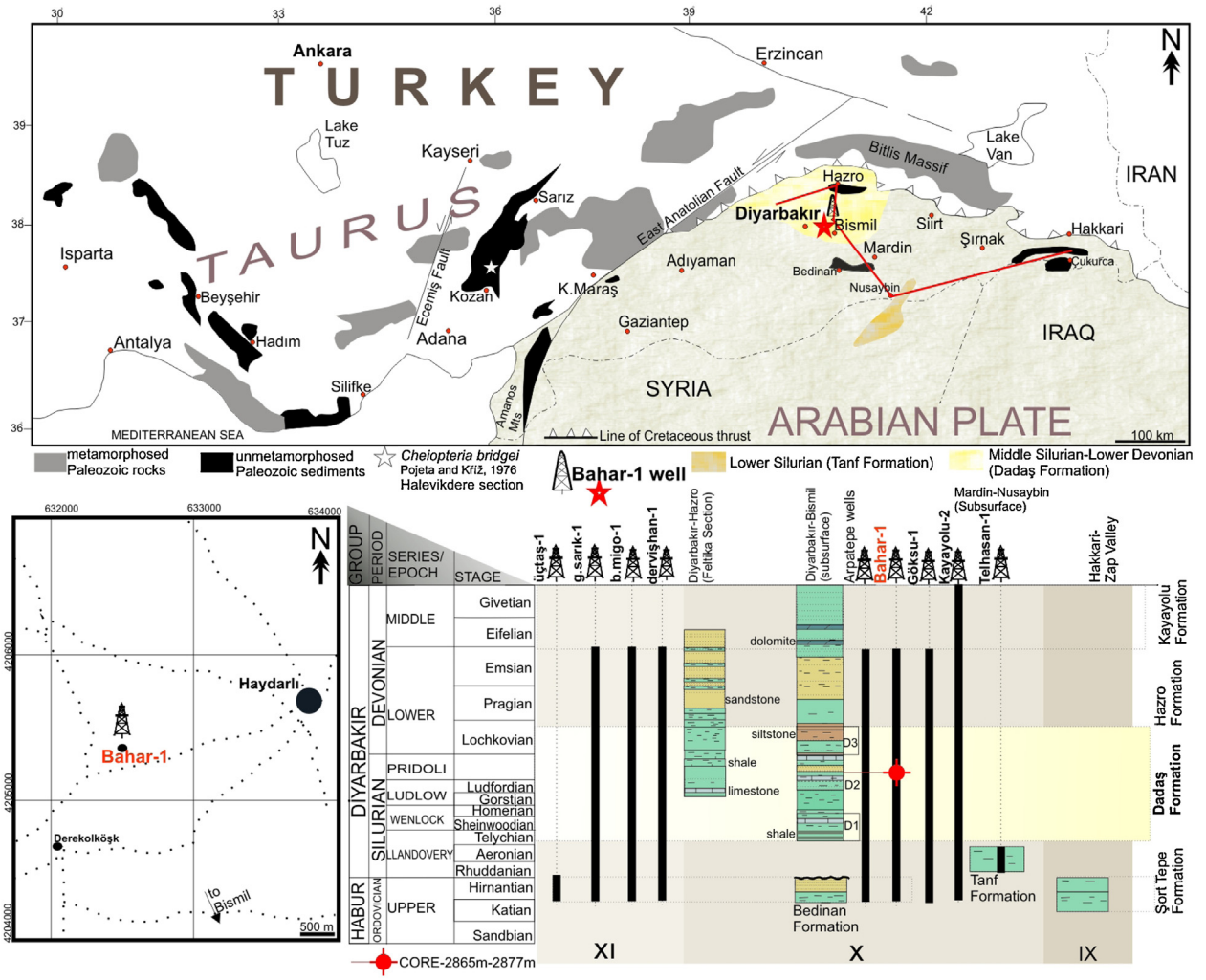

Fig. 1. (Color online). Location of the Bahar-1 well (red star), Diyarbakır area and schematic map showing the geographical location of the main investigated areas and wells in southeastern Turkey (Bozdoğan and Ertuğ, 1997; Bozdoğan et al., 1987, 1994; Lamsdell et al., 2013).
Fig. 1. (Couleur en ligne). Localisation du puits de Bahar-1 (étoile rouge), région de Diyarbakir et carte schématique montrant la localisation géographique des principales zones de recherche et des puits dans le Sud-Est de la Turquie (Bozdoğan et Ertuğ, 1997; Bozdoğan et al., 1987, 1994; Lamsdell et al., 2013).

Member is composed of similar shales alternating with some sandstones and the Dadaş 3 Member consists of an alternation of sandstones, marls and calcareous siltstones. The Dadaş Formation lies unconformably on the Middle-Upper Ordovician Bedinan Formation and is overlain conformably by the Devonian Hazro Formation (Fig. 2) (Bozdoğan et al., 1987; Kellog, 1960; Perinçek et al., 1991).

The individual members of the Early-Late Silurian (Wenlock- Pridoli) to Early Devonian (Lochkovian) age Dadaş Formation of the Diyarbakır area in SE Turkey were evaluated with respect to their potential for petroleum formation based on some organic-geochemical, petrographic and biostratigraphical analyses (Bozdoğan et al., 1994). The sedimentary sequence of the Dadaş–1 and –2 formations was evaluated on data from several deep boreholes, because due to the geologic situation, rock samples of this formation are not available as outcrops near the Diyarbakır-Bismil area (Bozdoğan et al., 1994; Erkmen and Bozdoğan, 1979; Steemans et al., 1996).

The Dadaş Formation was deposited on a restricted inner shelf, which was developed on the irregular paleotopography of the eroded Bedinan Formation. The respective shelf became shallower and was gradually converted to a tidal flat towards the top of the sequence (Bozdoğan et al., 1994; Yılmaz and Duran, 1997). The Dadaş Formation is equivalent to the Qalibah Formation in Saudi Arabia, Akkaş Formation in Iraq, Tanf Formation in Syria, and Mudawwara Formation in Jordan (Lüning et al., 2005).

3. Material and methods

Silurian rocks (Dadaş-1 and lower Dadaş-2 members) are not exposed in Diyarbakır area; however, they have been penetrated in several boreholes in southeastern Turkey (Fig. 1). Bahar-1 well (Longitude: 40° 30′ 30 986″E, Latitude: 37° 59′ 06 7114″N) (Fig. 2) is drilled to test the production potential of Silurian-Dadaş (primary target) and Devonian-Hazro (secondary target) sequences. The

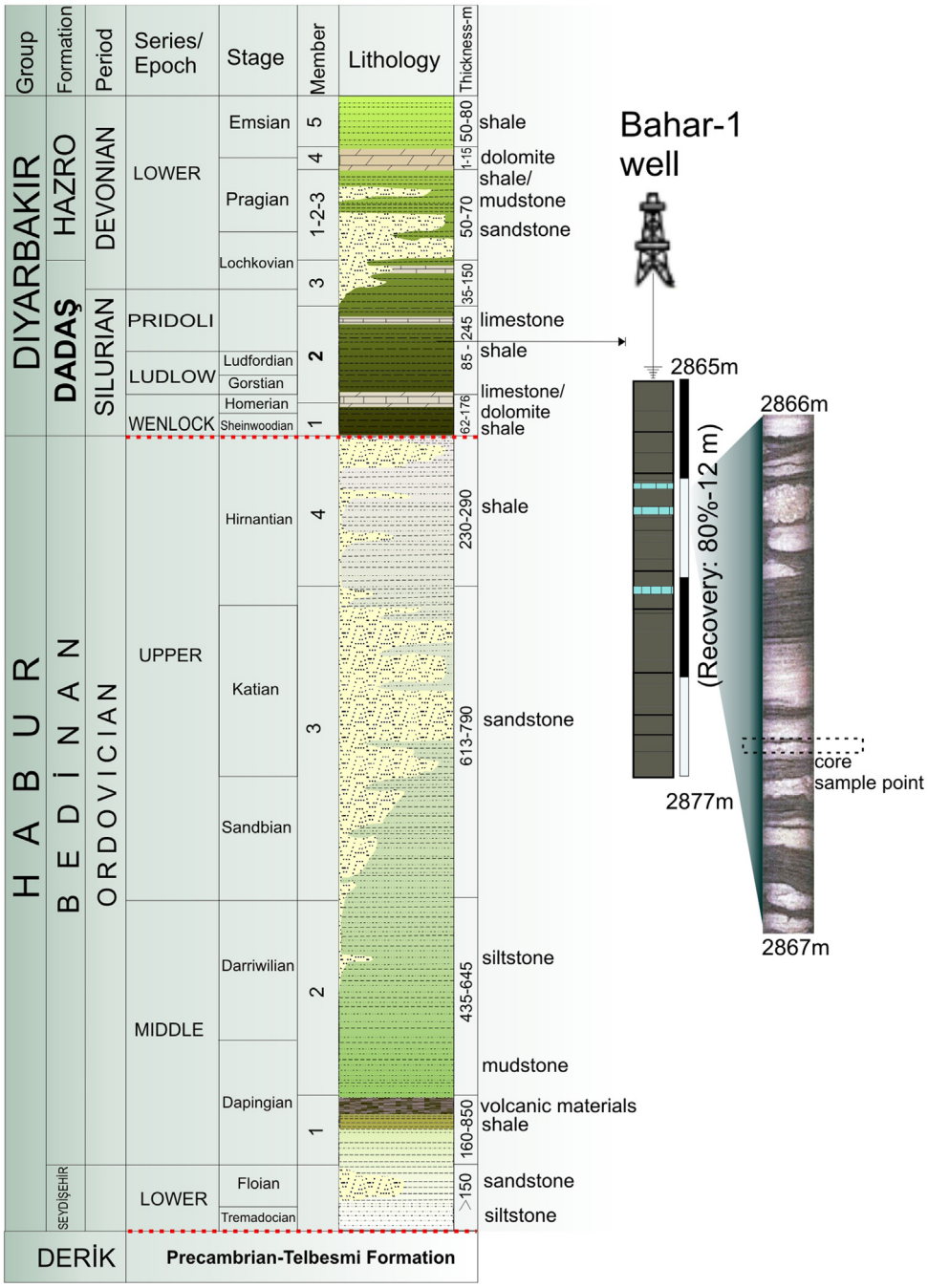

Fig. 2. (Color online). General columnar section of the Paleozoic succession in the Diyarbakır Basin (Bozdoğan et al., 1987, 1994) and lithologic section sample point of the Dadaş Formation in the well Bahar-1 core.
Fig. 2. (Couleur en ligne). Colonne stratigraphique d'ensemble du Paléozoïque du bassin de Diyarbakir (Bozdoğan et al., 1987, 1994) et section lithologique montrant le point d'échantillonnage de la Formation Dadaş dans la carotte du puits Bahar-1.

well field is located in Petroleum District X-Siirt, the south-eastern part of Anatolia.

The TransAtlantic Petroleum Corp-Bahar-1 well penetrated about 376 m of very dark gray to black shale, white, light gray limestone and sandstone, of which only the middle 12 m was cored (Fig. 2). The middle part 12 m (core 1, 2865–2877 m) contained the bivalve *Cardiolinka bohemica* (Fig. 3) and very poorly preserved orthoconic cephalopods.

4. Systematic palaeontology

The systematic arrangement of higher taxa largely follows the scheme proposed by Carter et al. (2011). The studied samples are from BHR1 GDA 01 and deposited in the Palaeontological Collection of Middle East Technical University by archive Nr: METU BHR1 GDA 01.

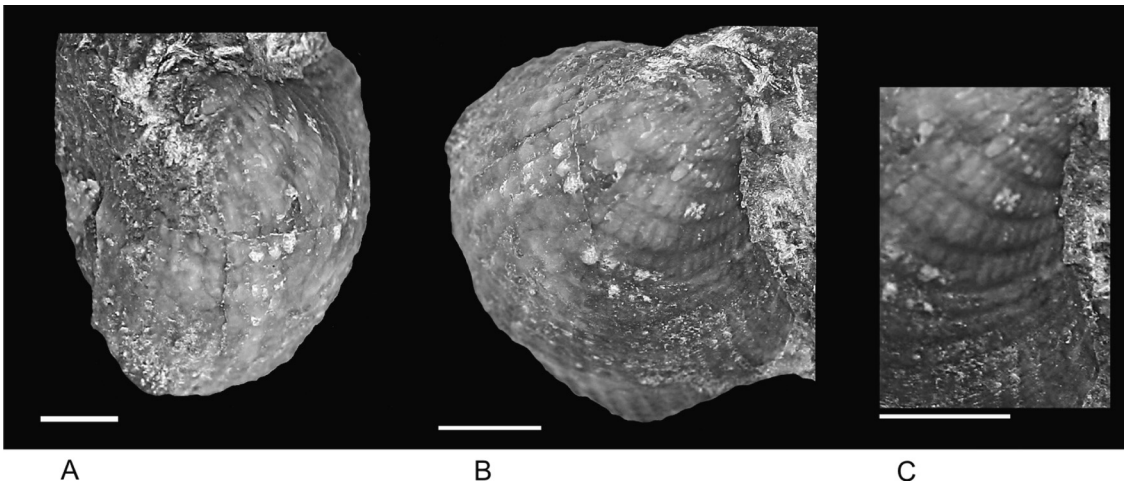

Fig. 3. *Cardiolinka bohemica* (Barrande, 1881) (BHR1 GDA 01). A–B. Right valve, external views, from the Bahar-1 core samples in the Diyarbakır area (Dadaş Formation). C. Detail of umbonal part (scale bars 5 mm).
Fig. 3. *Cardiolinka bohemica* (Barrande, 1881) (BHR1 GDA01). A–B. Valve droite, vues externes d'échantillons de la carotte du puits Bahar-1 dans la région de Diyarbakir (Formation Dadaş). C. Détail de la partie proche du crochet (barre d'échelle = 5 mm).

Class Bivalvia Linné, 1758
Subclass Autobranchia Grobben, 1894
Infraclass Pteriomorphia Beurlen, 1944
Order Cyrtodontida Scarlato and Starobogatov in Nevesskaja et al., 1971
Suborder Nepiomorphia Kříž, 2007 (=Praecardiidina Newell, 1965)
Hyporder Praecardioidei Newell, 1965
Superfamily Cardioloidea Hoernes, 1884
Family Cardiolidae Hoernes, 1884

Generally, the Bohemian type of fauna is characterized especially by epibyssate representatives of the families Cardiolidae (Kříž, 1999a). The Silurian family Cardiolidae Hoernes, 1884 consists of 13 genera: *Copenychia* Kříž, 2005 (Late Telychian); *Cardavia* Kříž, 2005 (Late Telychian); *Cardiobeleba* Kříž, 1974a (Early Sheinwoodian–Early Homerian); *Carnalpia* Kříž, 1974a (Late Sheinwoodian); *Cardiolopsis* Stache, in Heritsch, 1929 (Late Sheinwoodian); *Cominicula* Kříž, 1974a (Late Sheinwoodian); *Cardicarnia* Kříž, 1974a (Late Sheinwoodian); *Nutricula* Kříž, 1974b (Early Homerian); *Cardiola* Broderip, in Murchison, 1839 (Late Sheinwoodian–Early Pridoli); *Isiola* Kříž, 1976 (Late Sheinwoodian–Larly Přídolí); *Cardiolinka* Kříž, 1981 (Late Ludfordian–Late Pridoli); *Pygolfia* Kříž, 1974b (Early Ludfordian–Late Pridoli); *Snoopyia* Kříž, 1976 (Late Ludfordian–Late Pridoli) (Kříž, 2007) (Fig. 4).

Genus *Cardiolinka* Kříž, 1981

Type species. *Cardiolita bohemica* (Barrande, 1881), Bohemia, Prague Basin, Pridoli, Požáry Formation.

Discussion

The genus *Cardiolinka* represents most probably infaunal Cardiolidae and occurs from the Ludlow to Uppermost Pridoli mainly within the Gondwana, Perunica, Baltica and Arctic Canada regions (Kříž, 1999a, 1999b).

Cardiolinka bohemica (Barrande, 1881)
Fig. 3A–C.

1881 *Cardiola bohemica* Barrande, pl. 164, figs. IV/19–22; PL. 168, figs. 1–5, 6, II/3–4, III/1–6, IV/1, 2, V/3, 4, VI/3, 4, VIII/1, 2, X/1, 2, XI/1–4, XII/1, 2; PL. 169, figs. 1–5, 14–23, 26–28, 31/38; pl. 170, figs. 8–20.

1979 *Cardiolita bohemica* (Barrande, 1881), Kříž, p. 106–110, pl. 32, figs. 1–10; pl. 39, figs. 1–3, 5–11; pl. 40, fig. 7 (for complete previous synonymy see this paper).

1996 *Cardiolinka bohemica* (Barrande, 1881), Kříž, p. 48, pl. 4, figs. 7, 12, 16.

1999c *Cardiolinka bohemica* (Barrande, 1881), Kříž, p. 287, pl. 6, figs. 28–29; pl. 7, figs. 1–3.

Lectotype (designated by Kříž, 1974b). Internal mould of a left valve figured by Barrande in 1881 on pl. 169 as figs. 16–19, re-figured by Kříž (1979) on pl. 32 as figs. 4,7,10; deposited in the National Museum, Prague under no. NM L 6874.

Paralectotypes. All other specimens figured by Barrande in 1881, designated by Kříž (1979) as *Cardiolita bohemica* (=*Cardiolinka bohemica*) and deposited in the National Museum, Prague.

Type horizon. Lowermost layer of *Pristiograptus ultimus* zone, Požáry Formation, Pridoli.

Type locality. Dlouhá hora hill near the town of Beroun.

Description and discussion

The specimen is conspecific with Bohemian types. It shows characteristic general shape and size, growth bands divided into unequal parts by a shallow growth furrow with the ventral part larger. The width of radial gutters is smaller than width of the radial ribs; they are deeper than growth furrows. Also the type of radial ribs is characteristic as well as the very reduced swollen band which is practically similar to normal neighbouring growth bands (Kříž, 1979).

Material and dimensions (mm)

One right valve. BHR1 GDA 01, Stage V, L = 2.1, H = 2.2.

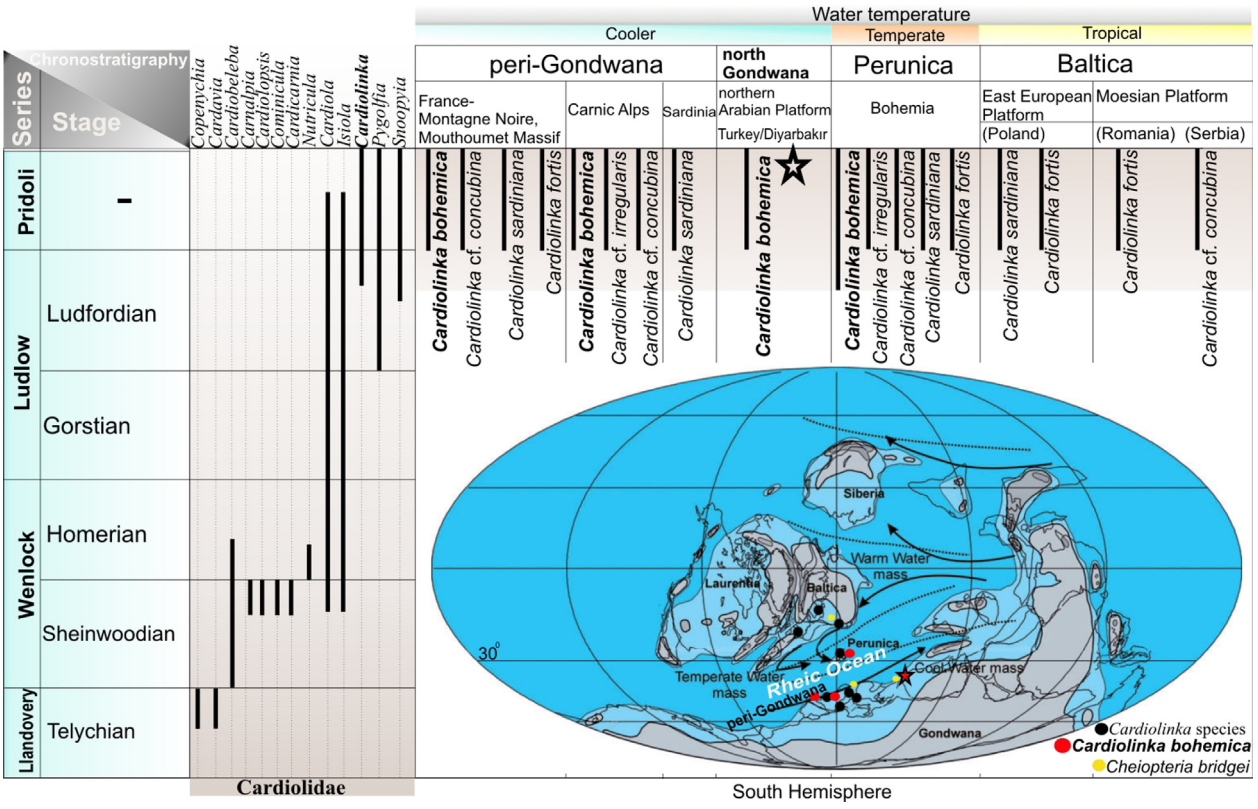

Fig. 4. (Color online). Stratigraphic range of Cardiolidae, latitudinal distribution of *Cardiolinka* species on the Rheic Ocean during the Late Silurian and paleomap of Cardiolids and *Cheiopteria bridgei* localities with location of the SE Turkey (Diyarbakır) (star). The primary data sources are: Cocks and Torsvik, 2002; Korejwo and Teller, 1964; Kříž, 1979, 1996, 1999a, 1999b, 2007, 2008; Kříž and Serpagli, 1993; Kříž and Veselinoviç, 1975; Pojeta et al., 1976; Turek and Manda, 2012.

Fig. 4. (Couleur en ligne). Gamme stratigraphique des Cardiolidae, répartition latitudinale de l'espèce *Cardiolinka* dans l'océan Rhéïque pendant le Silurien supérieur et paléocarte des sites à Cardiolidés et à *Cheiopteria bridgei*, avec localisation du Sud-Est de la Turquie (Diyarbakir) (étoile). Les sources primaires de données sont : Cocks et Torsvik, 2002 ; Korejwo et Teller, 1964 ; Kříž, 1979, 1996, 1999a, 1999b, 2007, 2008 ; Kříž et Serpagli, 1993 ; Kříž et Veselinoviç, 1975 ; Pojeta et al., 1976 ; Turek et Manda, 2012.

5. Palaeogeographical implications and conclusions

During the Paleozoic Era, the interactions between the continents of Laurentia, Baltica and Gondwana were governed by two major oceans: Iapetus and Rheic Ocean (Bozkurt et al., 2008; Nance et al., 2012). Late Silurian was the time of the major development of the Caledonian orogeny and final closure of the Iapetus. The Rheic Ocean, on the other hand, opened in the Early Ordovician and it is arguably the more important ocean of the two. Stretching from Mexico to the Middle East, it was the Rheic Ocean that separated the great paleocontinents of Gondwana and Laurussia as the principal interior ocean of the Paleozoic (Fig. 4) (Nance and Linnemann, 2008). The northern and southern Rheic domain was a large ocean as indicated by palaeomagnetic and biostratigraphic records from Ordovician and Silurian sediments (Cocks and Torsvik, 2002; Dojen, 2009a).

The Prague Basin of central Bohemia (Perunica), Montagne Noire, Mouthoumet Massif, Carnic Alps and Sardinia have been long considered as a classic areas for the Silurian bivalve biostratigraphy (Kříž, 1999b) and reference areas for correlation. Many Silurian Bivalvia dominated communities (*e.g.* *Cardiola* Community Group, *Cheiopteria* Community Group and *Snoopyia* Community Group) and index species were first distinguished and described from these areas (Ferretti and Serpagli, 1996; Kříž, 1999a; Kříž and Serpagli, 1993). During the Late Ludlow and Pridoli, some cardiolid bivalves (*Cardiola*, *Cardiolinka* and *Snoopyia*) became widely distributed outside peri-Gondwana. *Cardiolinka* is also known from the East European Platform (Poland) and the Moesian Platform (Romania and Serbia) (Korejwo and Teller, 1964; Kříž, 1996, 1999a, 1999b, 1999c, 2007, 2008; Kříž and Iordan, 1975; Kříž and Veselinoviç, 1975) (Fig. 4).

The Bohemian-type bivalve *Cardiolinka bohemica* (Barrande, 1881), which is characteristic for the Perunica, and peri-Gondwana region, occurs in the Latest Ludfordian to Pridoli of the Bohemia, France, and Carnic Alps (Fig. 4). Considering the palaeogeographic reconstructions, the locations of SE Turkey (North Arabian Platform), France, Carnic Alps and Sardinia during the Ludlow-Pridoli times were around 30° southern latitude and mainly concentrated on eastern margins of Rheic Ocean (Cocks and Torsvik, 2002; Tonarova et al., 2012; Turek and Manda, 2012). However, there are some paleomagnetic data that

locate Sardinia and the Carnic Alps at a palaeolatitude of 30–40°S for the Silurian (Schönlaub, 1997). The other occurrences of *Cardiolinka* are located at latitudes lower and higher than 30°, but on the western margins of the Rheic Ocean in Arctic Canada and on the coasts of Baltica (East European Platform). The position of Bohemia (Perunica) is less well constrained, but according to Kříž et al. (2003), and Cocks and Torsvik (2005) it was situated in more temperate climates northwest of the peri-Gondwanan area at slightly less than 30° S. Cardiolids were also recorded from Tajmyr, Russia (Kříž and Bogolepova, 1995), just north of the Equator, and from Guinea around 60° southern latitude (Kříž, 1979).

Havlíček (1999) argued, based on benthic faunas (mainly brachiopods and trilobites), that Perunica was much closer to Baltica than any other region of Gondwana, specifying its position at the northeastern corner of peri-Gondwana. A similar palaeogeographic scenario is suggested from the faunal distribution of nepiomorphian bivalves (*e.g.* Kříž, 2007) and particularly nautiloid cephalopods (Manda, 2008; Turek and Manda, 2012) and jawed polychaetes (Tonarova et al., 2012). It is not surprising that, although separated by an oceanic barrier, similar subtropic palaeolatitudes and shallow marine paleoenvironments are reflected by closely related benthic communities in the Late Silurian of Baltica, Perunica, peri-Gondwana and northern Gondwana.

During the Middle–Late Silurian, the northern parts of the Gondwana margin were quite close to the eastern coasts of peri-Gondwana. *Cardiolinka* was widely distributed during the Late Silurian in the tropical and subtropical shallow seas of Baltica and Perunica, even reaching the somewhat colder waters of the peri-Gondwanan basins (Fig. 4). Almost no provincialism, but rather the widest cosmopolitanism is characteristic for the Silurian Bivalvia, which were dispersed in most of the regions of the world (Kříž, 1999c; Kříž et al., 2011) due to their relatively long pelagic larval life and the relatively small distances among the basins, islands and continents on the Silurian Globe (Cocks and Torsvik, 2002, 2005). Up to now only a few occurrences of bivalve remains have been reported from the Middle - Late Silurian successions of eastern Taurides. Pojeta et al. (1976) were the first to describe a species *Cheiopteria bridgei* Pojeta and Kříž, 1976, from the Pridoli deposits at the Halevikdere locality in the Anatolian microplate and from the Cone well in Florida, USA. This palaeogeographically and palaeoecologically important cosmopolitan species was later described as representative of the *Cheiopteria* Community Group (Kříž, 1999a) from the Pridoli of the Armorican Massif (Kříž and Paris, 1982), Montagne Noire (Kříž, 1996), and Sardinia (Kříž and Serpagli, 1993). Moreover, the new record of the Bohemian-type bivalve *Cardiolinka bohemica* (Barrande, 1881) from northern Gondwana confirms the idea that the Silurian Bivalvia were mostly cosmopolitan.

Evidence from other fossil groups is also consistent with that of the bivalves. During the Middle-Late Silurian, the Rheic Ocean was not a major barrier against faunal and floral exchanges between Baltica, Perunica and Gondwana. Marine and nonmarine biogeographic patterns based on thelodonts, spores, macroplants, chitinozoans, acritarchs, conodonts, brachiopods, phragmoceratids and trilobites indicate broad similarities and support that the Rheic Ocean separating Baltica and northwestern Gondwana narrowed in the Middle-Late Silurian (Ferretti and Serpagli, 1996; Manda, 2008; Mergl, 2006). Recent studies of the beyrichioid ostracodes, *Hobergiella*, *Juviella*, *Hemsiella*, and *Macrypsilon* with these species from the middle and upper Dadaş Formation (Hazro Anticline-NE Diyarbakır) also suggested palaeobiogeographic relationships between North Gondwana and Baltica terranes (Dojen, 2009b).

The bivalve *Cardiolinka bohemica* (Barrande, 1881), representative of the suborder Nepiomorphia Kříž, 2007, is observed for the first time in the Silurian of Turkey. The species known originally from Bohemia thus documents its distribution in the northern Arabian Plate at northern parts of the Gondawana margin. The occurrence of the Late Ludlow–Pridoli Bohemian type bivalve *Cardiolinka bohemica* (Barrande, 1881) in the Arabian Plate represents another line of evidence in favour of strong faunistic affinity between Perunica, European peri-Gondwana, and the northern Gondwana margin.

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