Abstract. Palaeontological data available from the Azerbaijanian domains (Somkhit-Agdam, Sevan-Karabakh, and Miskhan-Kafan tectonic zones) of the Lesser Caucasus permit reconstruction of the regional taxonomic diversity dynamics of two groups of Early Cretaceous marine benthic invertebrates. Stratigraphical ranges of 31 species and 14 genera of brachiopods and 40 species and 31 genera of gastropods are considered. The total number of species and genera of brachiopods was low in the Berriasian–Valanginian and then rose to peak in the Barremian. Then, the diversity declined in the Aptian, and brachiopods are not known regionally from the Albian. Gastropods appeared in the Hauterivian and experienced a strong radiation in the Barremian. The diversity of species and genera declined in the Aptian (with a minor radiation in the Middle Aptian), and no gastropods are reported from the Albian. Globally, the number of brachiopod genera remained stable through the Early Cretaceous, and the number of gastropod genera increased stepwise with the maximum in the Albian. The regional and global patterns of the diversity dynamics differed for the both groups of marine benthic invertebrates. The Barremian maximum of the taxonomic diversity coincided with the regional flourishing of reefal ecosystems. The taxonomic diversity dynamics of brachiopods in the Azerbaijanian domains of the Lesser Caucasus is very similar to those of the Northern Caucasus, which is an evidence of proximity of these regions during the Early Cretaceous.

Key words: brachiopods, gastropods, taxonomic diversity, transgression, Early Cretaceous, Lesser Caucasus, Azerbaijan, Neo-Tethys Ocean.

Aпстракт. Палеонтолошки доступни подаци из Азербејџански домена (Сомкхит-Агдам, Севан-Карабаху, и Мискхан-Кафан тектонске зоне) Малог Кавказа дозвољавају реконструкцију динамику регионалних таксономских разноликости две групе доњокредних морских бентосних бескичмењака. Разматран је стратиграфски опсег 31 врсте и 14 рододова брахиопода и 40 врста и 31 род гастропода. Укупан број брахиоподских врста и родова је био низак у беријас-валендину, а врх разноликости достигао у барему. Затим, разноликост опада у апту, а од алба брахиоподи нису регионално познати. Гастроподе су се појавиле у отриву и доживела јаку експанзију у барему. Разноликост врста и родова опада у апту (са мањом експанзијом у средњем апту), а ниједан гастропод се не појављује од алба. Глобално, број брахиоподских родова остао је стабилен током доње креде, а број гастроподских родова је постепено повећан, са максимумом у албу. Регионални и глобални обрасци динамику различитост разликовала су се за обе групе морских бентосних бескичмењака. Баремски максимум таксономске разноликости поклопио са регионалним процватом гребенског екосистема. Динамика таксономске разноликости брахиопода у азербејџанским деловима Малог Кавказа је веома слична онима на северном Кавказу, што је доказ близине ових региона током ране креде.

Кључне речи: брахиоподи, гастроподи, таксономска разноврсност, трансгресија, рана креда, Мали Кавказ, Азербејџан, Неотетис.

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Introduction

Reconstructions of regional changes in taxonomic diversity of marine organisms are highly important for understanding spatial differences of biodiversity changes registered with the available global palaeontological data (SEPKOSKI 1993, 2002; ALROY et al. 2008; PURDY 2008; ALROY 2010). Particularly, the fossil record of the Caucasus, a large region stretching between the Black Sea and the Caspian Sea, is useful for analysis of the Cretaceous biotic evolution (RUBAN et al. 2011). Representative palaeontological data from this region were already compiled and published, but still unemployed for the analysis of diversity dynamics.

The present paper focuses on the Azerbaijani domains of the Lesser Caucasus (Fig. 1). Two groups of marine benthic macroinvertebrates, namely brachiopods and gastropods, are common in the Lower Cretaceous deposits of the study area (AKOPJAN & KHALILOV 1986; ALI-ZADEH 1988). These groups seem to be suitable for the analysis of the regional taxonomic diversity dynamics and its further comparison with the global patterns. This study is a part of the palaeobiological re-evaluation of the information about Cretaceous marine invertebrates from the Caucasus (see also RUBAN 2006, 2011a; RUBAN et al. 2011).

Geological setting

The Lesser Caucasus comprises a large southern portion of the Caucasus (Fig. 1). It occupies Armenia and parts of Azerbaijan and Georgia, as well as the neighbouring parts of Turkey and Iran. According to SHIKHALIBEYLI (1972), the Azerbaijani domains of the Lesser Caucasus include the Somkhit-Agdam, Sevan-Karabakh, and Miskhan-Kafan tectonic zones (the names are given in Russian transliteration). The exact Mesozoic plate tectonic setting of the Lesser Caucasus, which is a Gondwana-derived terrane (RUBAN et al. 2007), has been debated (LORDKIPANIDZE et al. 1984; GAMKRELIDZE 1986; GOLONKA 2004; ISMAIL-ZADEH 2007; ADAMIA et al. 2011). This terrane was located either in the midst of the Neo-Tethys Ocean or near its northern periphery (e.g., STAMPFLI & BOREL 2002; GOLONKA 2004) (Fig. 1). The Lesser Caucasus was affected by active tectonic processes in the Early Cretaceous, including hot-spot activity (AZIZBEKOV et al. 1972; ISMAIL-ZADEH 2007; ADAMIA et al. 2011; ROLLAND et al. 2009, 2011).

The regional Lower Cretaceous stratigraphy has been developed, particularly, by KHALILOV & ALIYEV (1972, 2007), AKOPJAN & KHALILOV (1986), ALI-ZADEH (1988), and ALIYEV & KHALILOV (2007). Generally, Lower Cretaceous deposits constitute the carbonate- and volcanioclastic-dominated successions with a total thickness of ~1500 m and more (KHALILOV & ALIYEV 1972, 2007; AKOPJAN & KHALILOV 1986; ALI-ZADEH 1988; ALIYEV & KHALILOV 2007) (Figs. 2, 3). The Urgonian limestones and reefs are abundant in the Barremian (JASAMANOV 1978; AKOPJAN & KHALILOV 1986; ALI-ZADEH 1988; AKHMEDOV et al. 2003; ALIYEV & KHALILOV 2007; KHALILOV & ALIYEV 2007) (Fig. 3). Clastic lithofacies are common in the upper part of the regional Lower Cretaceous succession (Fig. 2). The Lower Cretaceous deposits of the study area were accumulated in a shallow-marine open basin; the seawater was warm with normal salinity (JASAMANOV 1978; ALI-ZADEH et al. 1982). The sea was populated by different marine organisms, including ammonites, belemnites, bivalves, brachiopods, and gastropods (KHALILOV & ALIYEV 1972, 2007; AKOPJAN & KHALILOV 1986; ALI-ZADEH 1988; ALIYEV & KHALILOV 2007). Palaeobiogeographically, the fossil assemblages belonged to the Mediterranean–Caucasian Subrealm (WESTERMANN, 2000).
The available stratigraphical information (Khaliilov & Aliyev 1972, 2007; Akopian & Khaliilov 1986; Ali-Zadeh 1988; Aliyev & Khaliilov 2007) permits to indicate five regional transgressions (Fig. 2). These are interpreted on the basis of consideration of relative spatial distribution of marine deposits, erosional surfaces, and transgression surfaces. For instance, the limited occurrence of the pre-Barremian deposits in the Azerbaijani domains of the Lesser Caucasus relatively to the distribution of the Barremian deposits implies landward shoreline shift, i.e., transgression (sensu Catuneanu 2006), peaked in the Barremian. The largest was the Albian transgression (Jasamaronov 1978; Khaliilov & Aliyev 2007), which coincided with the global long-term sea-level rise (Haq 2014) and was, probably, triggered by the latter. Deposits of this age are the most widely distributed among the Lower Cretaceous sedimentary packages (Ali-Zadeh 1988; Aliyev & Khaliilov 2007; Khaliilov & Aliyev 2007). This transgression took place in the Middle Albian, and it is documented locally by transgressive surface between the Middle Albian and underlying deposits (Aliyev & Khaliilov 2007; Khaliilov & Aliyev 2007).

Materials and methods

This study employs regional and global stratigraphical ranges of Early Cretaceous brachiopods and gas-
tropods. The regional data on brachiopods (Appendix 1) were taken from Akopian & Khalilov (1986) and Ali-Zadeh (1988) with certain updates (e.g., *Cyetothyris pseudosella* (Lobatscheva) and *Praelogithyris pseudosella* Lobatscheva given as two distinct species in the original data source seem to be synonyms; *Cyclothyris gillieronii* Pictet, *C. picteti* Burri, and *C. renauxiana* D’Orbigny can be attributed to the genus *Lamellaerhynchia*). The work by Akopian & Khalilov (1986) synthesizes the information on the regional stratigraphy, and, among others, it lists common brachiopod taxa. The chapter by Zeyniyev & Lobatscheva in Ali-Zadeh (1988) is the first comprehensive taxonomic review of Cretaceous brachiopods from Azerbaijan, which remains essential source of the relevant information up to nowadays. These data are the result of regional sampling of many Early Cretaceous fossil localities in the Azerbaijani domains of the Lesser Caucasus. The global generic diversity of brachiopods was established by Curry & Brunton (2007). The regional data on gastropods (Appendix 1) were extracted from Ali-Zadeh (1988). Aliyev in Ali-Zadeh (1988) reviewed all available information about Early Cretaceous taxa reported from Azerbaijan, including those described earlier by Aliyev (1963). As in the case of brachiopods, the above-mentioned data were collected during sampling of many localities, and it is regionally representative. The global data on gastropods were taken from the compilation of Sepkoski (2002; see database on-line: http://strata.geology.wisc.edu/jack/start.php).

For the purposes of this quantitative analysis, two regional datasets were composed (Appendix 1). The first of them comprises stratigraphical ranges of 31 species of brachiopods belonging to 14 genera. The second dataset shows the stratigraphical distribution of 40 species of gastropods belonging to 31 genera. The presence of taxa is recorded at the scale of stages, but the distribution of Early Hauterivian–Middle Aptian gastropods (Late Aptian taxa were not reported at all) is also recorded at the level of substages (Appendix 1). All regional data were collected from numerous localities within the study area. As the data are given in the original sources, they characterise the entire region (not individual sections or outcrops), which is typical for palaeontological syntheses from the former USSR. Such information is very suitable for palaeobiological studies (see Ruban (2011b) for discussions).

The present quantitative analysis of the regional taxonomic diversity dynamics of brachiopods and gastropods includes evaluation of the total diversity (=total number of taxa), the number of appearances, and the number of disappearances by stages of the Early Cretaceous.Appearances and disappearances are preferred to originations and extinctions respectively, because the formers could be only temporal in regional records (see Ruban & Van Loon 2008). This analysis is done for both species and genera. For further comparisons of diversity patterns, the global changes in the total number of brachiopod and gastropod genera are also considered (no data on the global number of species are available). The taxonomic diversity dynamics are described herein at the level of stages. This resolution enables direct comparisons with the global diversity trends. Uncertainties related to different understandings of substages are avoided (cf. Ruban & Van Loon 2008). Also, a major part of the original data is attached to stages only. However, the available information on gastropods allows a tentative reconstruction of their diversity dynamics on the level of substages.

This study is based on the Early Cretaceous chronostratigraphical framework established by the International Commission on Stratigraphy (Gradstein et al. 2012; see the updated time scale on-line: stratigraphy.org). Some cautions are necessary when using data from the older palaeontological literature (Ruban 2011b). Particularly, there may be some differences between the regionally established Lower Cretaceous stages (Khalilov & Aliyev 1972, 2007; Akopian & Khalilov 1986; Ali-Zadeh 1988; Aliyev & Khalilov 2007) and the actual global stages (Gradstein et al. 2012; see the updated time scale on-line: stratigraphy.org). A brief examination of the regional biosтратigraphy (Khalilov & Aliyev 1972, 2007; Akopian & Khalilov 1986; Ali-Zadeh 1988; Aliyev & Khalilov 2007) suggests that some stage boundaries may be replaced downwards or upwards by about a triple of the stage length, but their exact position can be fixed only after detailed special investigations, and this is not the purpose of the present paper. However, the possible influence of the noted problem is considered in the interpretations of the results of this study (e.g., minor diversity changes are supposed to be within the error, and, thus, they are ignored). It should be also noted that the stratigraphical ranges employed for the purposes of the present study are based on generally consistent chrono- and biosтратigraphical frameworks used in the original sources (Akopian & Khalilov 1986, Ali-Zadeh 1988), and no major errors linked to differences in stage understanding in different works are expected.

**Results**

The number of brachiopod taxa changed significantly in the Azerbaijani domains of the Lesser Caucasus during the Early Cretaceous (Fig. 4). Few brachiopods are reported from the Berriasian and Valanginian deposits. However, the total brachiopod diversity increased in the Hauterivian and duplicated in the Barremian. The Aptian brachiopod assemblages were poor again, and the Albian brachiopods are unknown. The number of appearances tended to remain below
the number of disappearances (except for the Hauterivian). The Barremian total diversity maximum is a result of 16 species appearances in this stage and only 3 species disappearances in the Hauterivian. Very similar patterns of the generic diversity dynamics are registered (Fig. 4).

The number of gastropod taxa also varied during the Early Cretaceous (Fig. 5). The first gastropod taxon appeared regionally in the Hauterivian. The Barremian stage is characterised by a strong radiation of gastropods. The total diversity declined by about a half in the Aptian, but they remained relatively diverse in this stage. No gastropods are reported from the Albian deposits of the study area. The Barremian diversity maximum was a result of striking increase in the number of appearances in this stage. 27 species disappearances in the Barremian and only 8 species appearances in the Aptian reduced the gastropod diversity in the latter stage. As in the case of brachiopods, very similar patterns of the generic diversity dynamics are registered (Fig. 5). Consideration of the total diversity dynamics at a higher resolution demonstrates that gastropods radiated gradually through the Barremian, and their diversity increased slightly in the Middle Aptian to be followed by the total disappearance of gastropods already in the late Aptian (Fig. 6).

The comparison of the regional taxonomic diversity dynamics of the two groups of marine benthic invertebrates (Figs. 4, 5) implies that both reached the maximum in their total species and generic diversity in the Barremian. However, the brachiopod assemblages were more diverse in the Hauterivian than in the Aptian, whereas gastropods...
were relatively diverse in the Aptian and much less diverse in the Hauterivian. In other words, brachiopods experienced a gradual radiation and less gradual decline (Fig. 4), whereas gastropods experienced a strong radiation and gradual decline (Figs. 5, 6).

Moreover, these fossils were more similar by changes in the total number of genera on a regional scale than on a global scale. Therefore, it is unlikely that the regional taxonomic diversity dynamics was controlled by the global changes in the number of taxa. Of course, this conclusion is valid if no bias is significant. For instance, the restricted distribution of pre-Barremian strata (Aliyev & KHALILOV 2007; Khalilov & Aliyev 2007) may explain the low number of brachiopods and gastropods reported from them. The investigations that provided data for the compilations of Akopian & Khalilov (1986) and Ali-zadeh (1988) were regional in scale essentially. As shown in their works, each interval was studied with an equal attention. Thus, it is unlikely that sampling bias affect the taxonomic diversity reconstructions presented in this paper. As for the preservation bias, carbonate rocks, which are favourable for fossil preservation, are frequent in the entire Lower Cretaceous successions of the study territory (Khalilov & Aliyev 1972, 2007; Akopian & Khalilov 1986; Ali-zadeh 1988; Aliyev & Khalilov 2007) (Fig. 2).

Some regional palaeoenvironmental controls on diversity should be considered. The geological information summarized by Khalilov & Aliyev (1972, 2007), Akopian & Khalilov (1986), Ali-zadeh (1988), and Aliyev & Khalilov (2007) allows to outline several landward shoreline shifts that occurred in the Azerbaijanian domains of the Lesser Caucasus and either coincided with or differed from the global eustatic changes (HAQ 2014) (Fig. 2). It is unlikely that these transgressions (Fig. 2) were an ultimate control on the regional taxonomic diversity dynamics of either brachiopods or gastropods because of their different correspondence to the diversity changes (Figs. 4, 5). However, it cannot be excluded that the transgression peaked in the Barremian facilitated (or, at least, did not preclude) the rapid diversification of marine benthic macroinvertebrates, and the Aptian transgressions were, probably, responsible for the minor radiation of gastropods (Fig. 6). Interestingly, the global diversity of brachiopods (Fig. 4) and gastropods (Fig. 5) also did not correspond to the long-term eustatic changes reconstructed by Haq (2014) (Fig. 2).
Another possible palaeoenvironmental control on the reconstructed diversity dynamics was seawater temperature. It was evaluated regionally on the basis of isotope studies of benthic molluscs and belemnites. Results from such studies should be used with caution because of certain difficulties with isotopic data interpretation (e.g., Longinelli 1996, pers. comm.). The investigation by Jasamanov (1978) showed some cooling during the late Early Cretaceous. The seawater temperature dropped by 4–5 °C down to ~18 °C. Still, the water remained warm, and the basin was situated in or near the tropical climatic belt (Jasamanov 1978). The palaeotemperature analysis by Ali-Zadeh et al. (1982) showed cooling in the marine basin of Eastern Azerbaijan from ~22 °C to ~16 °C during the Valanginian–Barremian and then warming to ~22 °C in the Albian. The above-mentioned data from Jasamanov (1978) do not permit to judge about direct influences of seawater temperature on the fossil diversity. The results of Ali-Zadeh et al. (1982) imply that the diversity maximum was reached when the seawater was the coldest. If the latter is true, this is an unusual coincidence (one would expect fauna flourishing in warm-water conditions), and further investigations are necessary to confirm and to explain this.

The Barremian deposits of the Azerbaijani domains of the Lesser Caucasus bear reefs with diverse corals (Akopian & Khalilov 1986; Ali-Zadeh 1988; Akhmedov et al. 2003) (Appendix 2). It is broadly accepted that coral ecosystems sustained high taxonomic diversity in the geological past (Kiessling et al. 2010). The Urgonian facies with reefs are established in the study area (Jasamanov 1978; Akopian & Khalilov 1986; Ali-Zadeh 1988; Aliyev & Khalilov 2007; Khalilov & Aliyev 2007). These are also typical for many European regions (Császári 2002; Idakieva & Ivanov 2002; Masse et al. 2003, 2009; Bodin et al. 2006; Godet et al. 2010; Millan et al. 2011; Stein et al. 2012; Carevic et al. 2013; Godet 2013; Huck et al. 2013; Masse & Fenerci-Masse 2013), where they were formed in environments favourable for diversification of benthic invertebrates. The development of reefal ecosystems in the Barremian provides a plausible explanation of the strong diversification of brachiopods and gastropods relatively to Hauterivian and Aptian intervals. Anyway, the low diversity of these benthic macroinvertebrates in the Berriasian and the Valanginian, we well as their absence in the Albian remain enigmatic, because the regional palaeoenvironments (relatively shallow-water and warm seas with carbonate sedimentation) do not appear restrictive for diverse fossil communities (Fig. 2).

Globally, the Barremian is not known as a stage with the highest global distribution of reefs. Their quantity rose gradually through the Early Cretaceous, but the peak (not as pronounced as that of the Late Jurassic) was reached near the end of this epoch (Kiessling et al. 1999; see also Boggs 2006). The global generic diversity of Barremian corals (Löser 1996, 2005) was high, but not as exceptionally high (relatively to older and younger stages) as it was regionally (Ali-Zadeh 1988). Probably, the regional growth of reefal ecosystems in the only Barremian explains why the diversity maximum of marine benthic invertebrates is registered in the Azerbaijani domains of the Lesser Caucasus, but not globally in this stage.

The quantitative analysis by Ruban (2011a) permitted to register the taxonomic diversity dynamics of brachiopods in the Northern Caucasus, i.e., the northern part of the Greater Caucasus Basin. This dynamics can be compared with the diversity patterns established by the present study. The two regions are now located in the proximity of each others, but their relative position during the Early Cretaceous remains quite uncertain because of debates on the exact plate tectonic location of the Lesser Caucasus (Lordkipanidze et al. 1984; GamkrELidze 1986; Golonka 2004; Ismail-Zadeh 2007; Adamia et al. 2011). However, it is clear that the Lesser Caucasus was located to the south of the Greater Caucasus and within the same tectonic sector of the Neo-Tethys Ocean.

The total brachiopod species diversity in the Azerbaijani domains of the Lesser Caucasus was lower than that in the Northern Caucasus in the Berriasian, the Valanginian, and the Albian (Fig. 7). However, the total species number changed very similarly in these regions, and the Barremian diversity maximum was reached synchronously (Fig. 7). The total brachiopod generic diversity in the Azerbaijani domains of the Lesser Caucasus was lower than that in the Northern Caucasus during the Early Cretaceous, except for the Barremian and the Aptian. The only difference in the generic diversity dynamics between the two compared regions is the peak that was reached in the Barremian in the Azerbaijani domains of the Lesser Caucasus and in the Hauterivian in the Northern Caucasus. Such a similarity of the brachiopod taxonomic diversity dynamics between the two regions can be treated as an indirect evidence of their proximity in the Early Cretaceous. This matches the scenario, where both regions were situated at the northern margin of the Neo-Tethys Ocean. The comparison of assemblage composition between the Azerbaijanian domains of the Lesser Caucasus and the Northern Caucasus (Ruban 2011a) indicates certain number of common species and genera, which supports the conclusion about their proximity.

Conclusions

The quantitative analysis of the Early Cretaceous taxonomic diversity dynamics of two groups of marine benthic invertebrates, namely brachiopods and gastropods, allows some conclusions:
• the number of species and genera of brachiopods increased in the Hauterivian, peaked in the Barremian, and dropped rapidly in the Aptian;
• the number of species and genera of gastropods increased in an strongly in the Barremian and then declined in the Aptian;
• the regional and global changes in the total generic diversity differed for each fossil group;
• the regional development of reefal ecosystems in the Barremian was likely responsible for the regional diversity maximum of marine benthic macroinvertebrates;
• the patterns of the taxonomic diversity dynamics of brachiopods were similar between the study area and the Northern Caucasus.

Further investigations should be aimed at evaluation of the Early Cretaceous diversity dynamics of such fossil groups as ammonites and belemnites. Sequence stratigraphical architecture and palaeoenvironmental changes also need accurate reconstruction to judge about the possible extrinsic controls on the fossil diversity.

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Број гастроподских таксона такође варира током постају сиромашне, а у албу су потпуно непознате. Током апта брахиоподске заједнице поново повећава се у отриву, а дуплира у бармски век се карактерише значајном радијацијом пужева. Током апта њихова укупна разноврсност опада и упола је мања, мада су ипак и даље релативно разноврсни. Напласи гастропода нису потврђени из албских наслага проучаваног подручја. У албским седиментима проучаваног подручја пужви потпуно изостају. Поређење динамике регионалне таксономске разноврсности ове две групе морских бентосних бескичмењака указује на то да су обе групе достигле максимум у укупном броју врста и генеричке разноврсности у брему. Међутим, код брахиопода је дошло до постепене радијације и бржег опадања разноврсности, а код пужева такође не одговара дугорочним променама нива мора. Развој спрудних екосистема у барему би могао да буде објашњење за велику разноврсност брахиопода и пужева у односу на отривске и албске интервале. На глобалном нивоу барем је максимум разноврсности морских бентосних бескичмењака забележен у Азербејџанским областима Малог Кавказа, али не глобално у овом кату.

Резиме

Динамика таксономске разноврсности доњокредних брахиопода и пужева у Азербејџанским областима Малог Кавказа (Нео-Тетис)

Фосилни налази Кавказа, велике области која се протеже између Црног мора и Каспијског мора, је карактерисана биотичким еволуцијом крехе. Брахиоподи и пужеви су чести у доњокредним наслагама у Азербејџанским областима Малог Кавказа. Ове фосилне групе су погодне за анализу регионалне таксономске разноврсности. Сличност у динамици брахиоподских таксона као и за њено даље поређење на глобалним нивоу.

Максимална разноврсност морских бентосних бескичмењака указује на то да су обе групе достигле максимум у укупном броју врста и генеричке разноврсности у брему. Међутим, код брахиопода је дошло до постепене радијације и бржег опадања разноврсности, а код пужева такође не одговара дугорочним променама нива мора. Развој спрудних екосистема у барему би могао да буде објашњење за велику разноврсност брахиопода и пужева у односу на отривску интервале. На глобалном нивоу барем није познат као век са највећим распрострањењем спрудова. Њихова бројност је постепено опадала од брежег опадања разноврсности, док је код брахиопода дошло до постепене радијације и бржег опадања разноврсности, док је код пужева радијација била израженија и било је вероватно да су регионалне трансгресије биле главни фактор који је контролисао динамику регионалне разноврсности брахиопода и пужева. Уврставање динамики брахиоподских таксона код брахиопода и радијација брахиопода и пужева такође не одговара дугорочним променама нива мора. Развој спрудних екосистема у барему би могао да буде објашњење за велику разноврсност брахиопода и пужева у односу на отривске и албске интервале. На глобалном нивоу барем није познат као век са највећим распрострањењем спрудова. Њихова бројност је постепено опадала от крајем ове епохе. Вероватно да су регионалне трансгресије биле главни фактор који је контролисао динамику регионалне разноврсности брахиопода и пужева. Уврставање динамики брахиоподских таксона код брахиопода и радијација брахиопода и пужева такође не одговара дугорочним променама нива мора. Развој спрудних екосистема у барему би могао да буде објашњење за велику разноврсност брахиопода и пужева у односу на отривске и албске интервале. На глобалном нивоу барем није познат као век са највећим распрострањењем спрудова. Њихова бројност је постепено опадала от крајем ове епохе. Вероватно да су регионалне трансгресије биле главни фактор који је контролисао динамику регионалне разноврсности брахиопода и пужева. Уврставање динамики брахиоподских таксона код брахиопода и радијација брахиопода и пужева такође не одговара дугорочним променама нива мора. Развој спрудних екосистема у барему би могао да буде објашњење за велику разноврсност брахиопода и пужева у односу на отривске и албске интервале.
Appendix 1. Stratigraphical distribution of Early Cretaceous brachiopods and gastropods in the Azerbaijani domains of the Lesser Caucasus. Based on data from Akopjan & Khalilov (1986) and Ali-zadeh (1988) with improvements. See text for more explanations.

**BRACHIPODS**

| Taxa                                | Berriasian | Valanginian | Hauterivian | Barremian | Aptian | Alban |
|-------------------------------------|------------|-------------|-------------|-----------|--------|-------|
| *Cruralina cruralinica* SMIRNOVA    |            |             |             |           |        |       |
| *Cyclothyris ardeica* (JACOB et FALLOT) |            |             |             |           |        |       |
| *Cyclothyris castellanensis* (JACOB et FALLOT) |            |             |             |           |        |       |
| *Cyclothyris contractoides* JACOB et FALLOT |            |             |             |           |        |       |
| *Cyclothyris irregularis* (PICTET)  |            |             |             |           |        |       |
| *Cyclothyris kiprisovae* (MOISSEEV in LOBATSHEVA) |            |             |             |           |        |       |
| *Cyclothyris larwoodi* (OWEN)       |            |             |             |           |        |       |
| *Cyclothyris latu* (D’ORBIGNY)      | x          |             |             | x         | x      |       |
| *Cyclothyris tenuicostata* LOBATSHEVA |            |             |             |           |        |       |
| *Cyrtothyris kentugajensis* (MOISSEEV) |            |             |             |           |        |       |
| *Cyrtothyris middlemissi* Calzada   | x          |             |             |           |        |       |
| *Cyrtothyris minor* (LOBATSHEVA)    |            |             |             |           |        |       |
| *Cyrtothyris pseudosella* (LOBATSHEVA) |            |             |             |           |        |       |
| *Dzirulina marianovkaensis* (MOISSEEV in SMIRNOVA) |            |             |             |           |        |       |
| *Fortunella decipiens* (D’ORBIGNY)  |            |             |             |           |        |       |
| *Lacunosella cherennensis* (JACOB et FALLOT) |            |             |             |           |        |       |
| *Lacunosella malbosi* (PICTET)      | x          |             |             | x         | x      |       |
| *Lamellaerhynchia gillieroni* (PICTET) |            |             |             |           |        |       |
| *Lamellaerhynchia picteti* BURRI     | x          |             |             |           |        |       |
| *Lamellaerhynchia renaiscens* (D’ORBIGNY) |            |             |             |           |        |       |
| *Loriolothyris russilensis* (DE LORIOL) |            |             |             |           |        |       |
| *Moutonithrys karakaschi* MOISSEEV  |            |             |             |           |        |       |
| *Moutonithrys moutoniana* (‘DORBIGNY) |            |             |             |           |        |       |
| *Nucleata cf. strombecki* (SCHLOENBACH) |            |             |             |           |        |       |
| *Sellithyris campichei* (PICTET)    | x          |             |             | x         | x      |       |
| *Sellithyris sella* (SOWERBY)       | x          |             |             | x         | x      |       |
| *Terebrirostra? aff. neocomiensis* D’ORBIGNY |            |             |             |           |        |       |
| *Terebrirostra taurica* (MOISSEEV)  | x          |             |             |           |        |       |
| *Torquirhynchia asterana* (D’ORBIGNY) |            |             |             |           |        |       |
| *Torquirhynchia aurea* (ELLIOTT)    | x          |             |             |           |        |       |
| *Tropeothyris salevensis* (DE LORIOL) |            |             |             |           |        |       |
### GASTROPODS (listed per stages)

| Taxa                                             | Berriasian | Valanginian | Heteriian | Barremian | Aptian | Albian |
|--------------------------------------------------|------------|-------------|-----------|-----------|--------|--------|
| Ampullospira kurdistanica (ALIEV)                | x          |             |           |           |        |        |
| Ampullospira subunensis ALIEV                    |            |             | x         |           | x      |        |
| Archimedea archimed (ORBIGNY)                    |            |             | x         |           |        |        |
| Balkanella garthiensis (ALIEV)                   |            |             |           | x         |        |        |
| Campichlia azerbaijanensis ALIEV et LYSENKO       |            |             |           | x         |        |        |
| Campichlia margaritae ALIEV et LYSENKO            |            |             |           | x         |        |        |
| Columbellina maxima LOR.                         |            |             |           | x         |        |        |
| Confusiscala sp.                                 |            |             |           | x         |        |        |
| Contortella cylindrica ALIEV                      |            |             |           | x         |        |        |
| Contoriella tuberculata ALIEV                     |            |             |           | x         |        |        |
| Cylindrobulina genialensis ALIEV                 |            |             |           | x         |        |        |
| Cylindroptyxix pellati (COSSMANN)                |            |             |           | x         |        |        |
| Dalmatea bicarinata ALIEV                         |            |             |           | x         |        |        |
| Diozyoptixis coquandi (ORBIGNY)                  | x          | x           |           |           |        |        |
| Diozyoptixis renauri (ORBIGNY)                   |            |             |           | x         |        |        |
| Diozyoptixis traversensis PICT. et CAMP.         |            |             |           |           |        |        |
| Dipityxiella transcaucasicica ALIEV et LYSENKO    | x          | x           |           |           |        |        |
| Diptyxis subdistincta ALIEV                       |            |             |           |           | x      |        |
| Funiptixis pcelincevi ALIEV                       |            |             |           |           |        | x      |
| Harpogodes pelagi (BRONG.)                       | x          | x           |           |           |        |        |
| Helicaniix caucasicum ALIEV                       |            |             |           |           | x      |        |
| Lissochitus subantoni (ALIEV)                     |            |             |           |           | x      |        |
| Lyosoma capduri COSSMANN                         |            |             | x         |           | x      |        |
| Microchitza nicchiici PCELINCEV                   |            |             | x         |           |        |        |
| Neoptixis formosa PCELINCEV                       | x          |             |           |           | x      |        |
| Nerinella algarbiensis CHOFF.                     | x          |             |           |           |        |        |
| Oonia pseudoovalis ALIEV                          |            |             | x         |           |        |        |
| Phaneroptyxix arnauti (MATH.)                    |            |             | x         |           |        |        |
| Phaneroptyxix balkanensis (PCELINCEV)             | x          |             |           |           |        |        |
| Pleurotomaria subjaccardi PCELINCEV               | x          |             |           |           |        |        |
| Proacirsa proventali COSSMANN                    | x          |             |           |           |        |        |
| Purpuroidca pcelincevi ALIEV                      |            |             | x         |           |        |        |
| Salinea alizadei (ALIEV)                          |            |             |           |           | x      |        |
| Salinea pseudobella (DVALI)                       | x          |             |           |           |        |        |
| Sculpturea fokhtiana (MORT.)                     | x          |             |           |           |        |        |
| Trochonatica bruguieri (MATH.)                    | x          |             |           |           |        |        |
| Tylostoma depressum PIC. et CAMP.                 | x          |             |           |           |        |        |
| Tylostoma paramaticoide ALIEV                     | x          |             |           |           |        |        |
| Tylostoma rochiatumum PIC. et CAMP.               | x          |             |           |           |        |        |
| Umbanea favrei ALIEV                              | x          |             |           |           |        |        |
| Taxa | Early Haeteviian | Late Haeteviian | Early Barremian | Late Barremian | Early Aptian | Middle Aptian |
|------|-----------------|----------------|-----------------|----------------|--------------|--------------|
| *Ampullospira kurdistanica* (ALIEV) | x              |                |                 |                |              | x            |
| *Ampullospira subupensis* ALIEV     |                |                |                 |                |              |              |
| *Archimedea archimedi* (ORBIGNY)   | x              |                |                 |                |              |              |
| *Balkanella garthiensis* (ALIEV)   |                |                |                 |                |              | x            |
| *Campichia azerbajianensis* ALIEV et LYSSENKO | x | x | x | x | x | x |
| *Campichia margaritae* ALIEV et LYSSENKO | x | x | x | x | x | x |
| *Columbellina maxima* LOR.         |                |                |                 |                |              |              |
| *Conusiscida* sp.                  |                |                |                 |                |              | x            |
| *Contortella cylindrica* ALIEV      |                |                |                 |                |              |              |
| *Contortella tuberculata* ALIEV     |                |                |                 |                |              |              |
| *Cylindrobotina geotakensis* ALIEV  |                |                |                 |                |              |              |
| *Cylindrophytis pellati* (COSMANN) | x | x | x | x | x | x |
| *Dalmatia bicarinata* ALIEV        |                |                |                 |                |              |              |
| *Diozyptis coquandi* (ORBIGNY)     |                |                |                 |                |              |              |
| *Diozyptis renaxii* (ORBIGNY)      |                |                |                 |                |              |              |
| *Diozyptis traversensis* PICT. et CAMP. | x | x | x | x | x | x |
| *Diptychella transcaucasica* ALIEV et LYSSENKO | x | x | x | x | x | x |
| *Diptychella subdistincta* ALIEV    |                |                |                 |                |              |              |
| *Fumtyxis pelcincevi* ALIEV        |                |                |                 |                |              |              |
| *Harpogodes pelagi* (BRONG.)       |                |                |                 |                |              |              |
| *Helicanula cancasicum* ALIEV      |                |                |                 |                |              |              |
| *Lissocochilus subantonii* (ALIEV)  |                |                |                 |                |              |              |
| *Lyosoma capduri* COSMANN          |                |                |                 |                |              |              |
| *Microchiza nickchici* PCELINCEV    |                |                |                 |                |              |              |
| *Neoptysis formosa* PCELINCEV       |                |                |                 |                |              |              |
| *Nerinella algariensis* CHOFF.     |                |                |                 |                |              |              |
| *Oonia pseudoovalis* ALIEV         |                |                |                 |                |              |              |
| *Phaneroptyxis arnani* (MATH.)     |                |                |                 |                |              |              |
| *Phaneroptyxis balkanensis* (PCELINCEV) | x | x | x | x | x | x |
| *Pleurotomaria subjaccardi* PCELINCEV | x | x | x | x | x | x |
| *Prosarcira provenci* COSMANN      |                |                |                 |                |              |              |
| *Purpuroidea pelcincevi* ALIEV     |                |                |                 |                |              |              |
| *Satlinea alzadei* (ALIEV)         |                |                |                 |                |              |              |
| *Satlinea pseudobella* (DVALI)     |                |                |                 |                |              |              |
| *Sculpturea fogtiana* (MORT.)      |                |                |                 |                |              |              |
| *Trochonatica bruguierii* (MATH.)  |                |                |                 |                |              |              |
| *Tylostoma depressum* PICT. et CAMP. | x | x | x | x | x | x |
| *Tylostoma parmaticoide* ALIEV     |                |                |                 |                |              |              |
| *Tylostoma rochianum* PICT. et CAMP. | x | x | x | x | x | x |
| *Umbanea favrei* ALIEV             |                |                |                 |                |              |              |
Appendix 2. Stratigraphical distribution of Early Cretaceous coral genera in the Azerbaijanian domains of the Lesser Caucasus. Only Barremian and Aptian taxa were reported from this region. Based on data from Ali-Zadeh (1988) with improvements.

| Taxa                  | Stages       |
|-----------------------|--------------|
|                       | Barremian    | Aptian      |
| Actinastrea           | ×            |             |
| Clausastrea           | ×            |             |
| Cryptocoenia          | ×            |             |
| Dimorphocoenia        | ×            |             |
| Eohydnocthora         | ×            |             |
| Eudyra                | ×            |             |
| Holocystis            | ×            | ×           |
| Hydnophoromeandraraea | ×            |             |
| Mesomorpha            | ×            |             |
| Metaaulastraea        | ×            |             |
| Microsolenia          | ×            |             |
| Placocolumastrea      | ×            |             |
| Polyphylloseris       | ×            |             |
| Pseudopolytremacis    | ×            |             |
| Rhipidomeandra        | ×            |             |
| Stelidioseris         | ×            |             |
| Thecosmilia           | ×            |             |