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TAPHONOMIC AND PALAEOECOLOGICAL SIGNS OF DIASTEMS IN THE CARBONIFEROUS SUCCESSION OF THE DON-DNIPRO THROUGH, UKRAINE

No more than 10-25% of the Earth's history is documented in the sedimentary record, and most of this corresponds to diastems, a short interruption in deposition with little or no erosion before resumption of sedimentation [1, 3]. Stratigraphic gaps (or hiatuses, breaks) are an integral feature of any sedimentary sequence and their presence is guaranteed by the so-called Principle of the incompleteness of the stratigraphic record, i.e. the stratigraphic record in the form of rock sequences of the Earth's sedimentary cover is incomplete because a significant part of geological time in each particular section is not documented by rocks and corresponds to stratigraphic gaps [2]. Stratigraphic gaps occur in various ways: as a result of erosion in subaerial or aquatic environments, non-deposition of sediments due to hydrodynamic activity of the environment or lack of sedimentary material, and leaching of fine components [6]. Thus, formally, stratigraphic gaps can be divided into (1) syn-sedimentary and early diagenetic, (2) post-sedimentary [1, 8].

In addition to determining the correlation between the duration of sediment accumulation in the Earth's sedimentary cover and physical time, stratigraphic gaps analysis is necessary to restore the peculiarities of geotectonic processes in the geological past, to identify the mechanisms of anticline uplift formation, and to search for stratigraphic, lithological, and combined hydrocarbon traps [6, 7]. In recent decades, due to the gradual depletion of anticline hydrocarbon traps in the Dnipro-Donets Depression, more and more attention has been paid to the search for non-anticline traps, especially stratigraphic traps, the search criterion for which is often the presence of signs of stratigraphic gaps [5]. For example, ten stratigraphic gaps have been identified in the Tournaisian (Mississippian) sedimentary succession of the Hnidentsivska Uplift, to which the T1–T5 productive horizons are confined [7].

The presence of stratigraphic gaps in the Carboniferous succession of the Don-Dnipro Trough is recorded by radiometric, lithological and palaeontological (biostratigraphic, taphonomic and palaeoecological) methods. Among the taphonomic and palaeoecological signs of diastems in the Carboniferous succession of the Don-Dnipro Trough are: (1) characteristic trace fossils (e.g., bioerosions *Rogerella, Gnathichnus* and *Cyclopuncta* (Fig. 1A, D, E), burrows *Bergaueria* opened onto the erosional surface (Fig. 1J) or bioerosion traces on the hard- or rockground surfaces (e.g., see [8: Fig. 2B]); (2) microbially-induced sedimentary structures (Fig. 1I); (3) biotic communities that existed on compacted and hard substrates (e.g., skeletons of dead and living animals (Fig. 1F), rock- and hardgrounds, etc.); (4) paleosoil horizons and evidences of soil-forming processes (Fig. 1G); (5) biogenic buildups (bioherms, biostromes) and microbialites (stromatolites, thrombolites, oncolites) (Fig. 1B, H); (6) trunks and roots of arborescent lycopsids and sphenopsids preserved *in situ* (Fig. 1C), etc.

However, only biostratigraphic criteria allow us to determine the stratigraphic extent of a stratigraphic gap, i.e. to estimate the number of stratigraphic units that are missing in the sedimentary sequence as a result of erosion or non-deposition, and thus to determine the duration of the gap in absolute terms (i.e. in years). The above taphonomic and palaeoecological evidences allow us to detect the presence of diastems, but they are not sufficient to estimate the physical time that is not documented in the sedimentary sequence.

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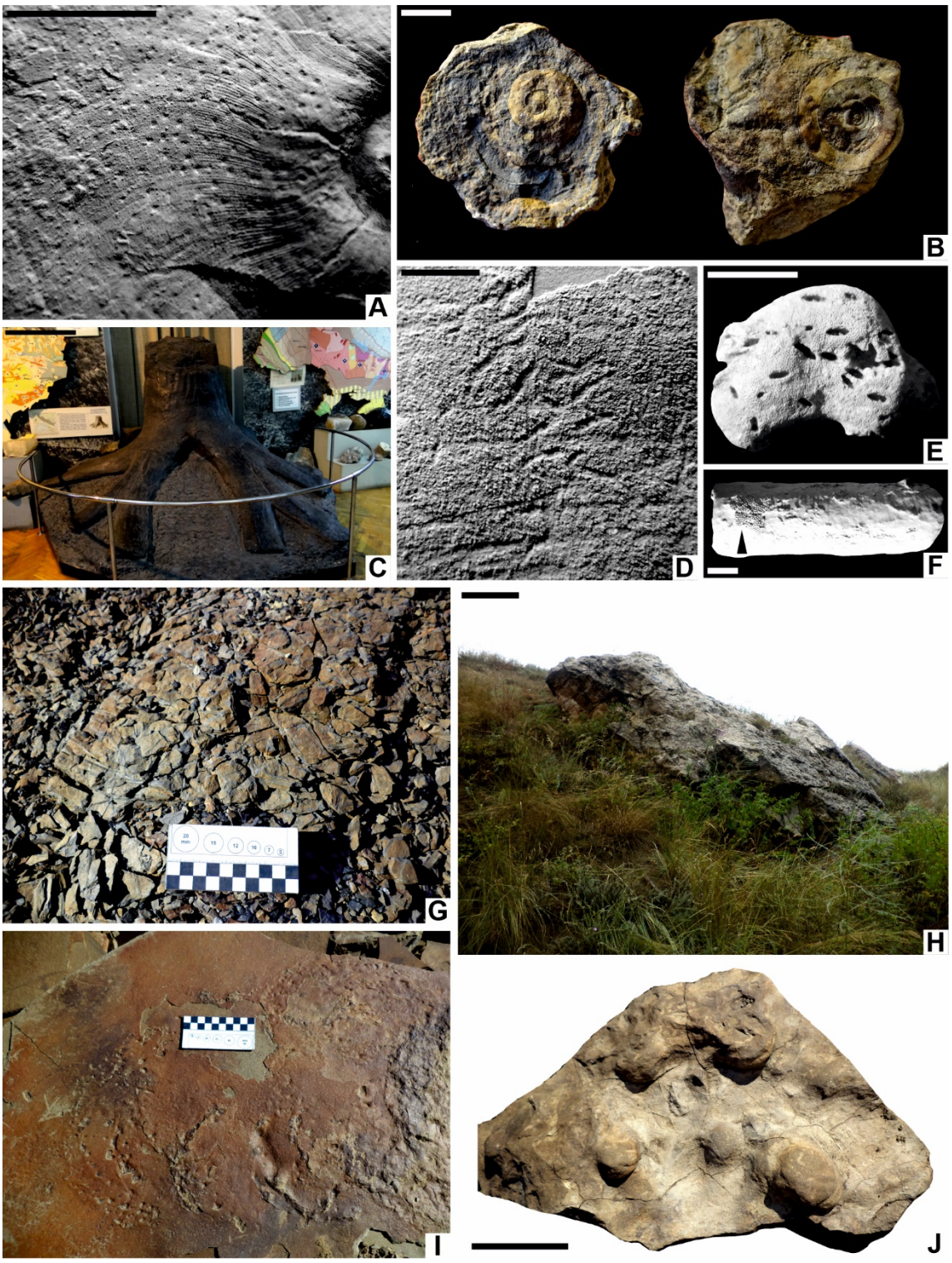

Fig. 1. Palaeoecological and taphonomic evidences for the presence of diastems in the Carboniferous of the Don-Dnipro Trough. A – bierosion trace fossils *Cyclopuncta* on the cephalopod conch (Visean, Dnipro-Donets Depression); B – oncolites with ammonoid conchs (Serpukhovian, Donets Basin); C – trunk of the arborescent lycopsid *Sigillaria* preserved *in situ* (Moscovian, Donets Basin); D – bierosion trace fossils *Gnathichnus* on the orthocerid nautiloid (Serpukhovian, Donets Basin); E – bierosion trace fossils *Rogerella* in an oncolite or limestone pebble (Moscovian, Donets Basin); F – crinoid stem with attached epibiontic bryozoan (Visean, Donets Basin); G – histosol below the g_3 coal bed of the Mospyne Formation (Bashkirian, Donets Basin); H – microbial limestone layer L_7, which lies on sandstone bed with an erosion contact (Moscovian, Donets Basin); I – microbially-induced sedimentary structure on the sandstone bedding plane (Bashkirian, Donets Basin); J – sandstone slab with sea anemone burrows *Bergaueria hemispherica* Crimes et al., 1977 (Bashkirian, Donets Basin). Scale bars = 5 mm (D), 10 mm (A, B, E, F), 0.1 m (G, I, J), 0.5 m (C, H).

References

1. Baraboshkin E.Yu., Weimarn A.B., Kopaevich L.F., Naydin D. P. Study of stratigraphic breaks during geological survey: Methodical recommendations. Moscow: Moscow University Press, 2002. 163 p.
2. Mesezhnikov M.S., Stepanov D.L. General stratigraphy. Principles and methods of stratigraphic studies. Leningrad: Nedra, 1979. 423 p.
3. Nalivkin D.V. 1974. Problem of stratigraphic gaps. In: Yanshin A.L. (Ed.), Etudes on stratigraphy. Moscow: Nauka, p. 10–21.
4. Ogar V.V. On the genesis of carbonate rocks of the Mokra Volnovakha Group (Lower Carboniferous of the southern Donets Basin). Collection of scientific works of the Institute of Geological Sciences of the NAS of Ukraine. 2008. Vol. 1. P. 132–139.
5. Popova T.L. Geological criteria for preserving the productivity of non-anticlinal traps in the Tournaisian–lower Visean terrigenous deposits of the Dnipro-Donets Depression. Collection of scientific works of the Institute of Geological Sciences of the NAS of Ukraine. 2009. Vol. 2. P. 47–51.
6. Staroverov V.N. Stratigraphic gaps in the Palaeozoic deposits of the SE part of the Russian Plate. Bulletin of the Voronezh University, Geology. 2013. No. 2. P. 40–45.
7. Vakarchuk G.I., Havrysh V.K. Stratigraphic breaks and unconformities in the Palaeozoic deposits of the Dnipro-Donets Depression. Geological Journal (Ukraine). 1991. No. 1. P. 119–130.
8. Zaitsev A.V., Baraboshkin E.Yu. Stratigraphic gaps in the Lower and Middle Ordovician deposits of the NW part of the Russian Plate. Bulletin of the Moscow University, Geology. 2006. No. 3. P. 17–24.