BIOSTRATIGRAPHIC INDICATIONS OF END CRETACEOUS AGE OF THE BOLTYSH IMPACT CRATER (UKRAINIAN SHIELD) Anton Valter[1] and Ludmila Plotnikova[2] [1]Institute of Applied Physics of National Academy of Science, Department N 50, Nauki Avenue 46, Kiev 39, 03650, Ukraine (avalter@iop.kiev.ua) [2]Institute of Geological Sciences of National Academy of Science,55B Gonchara str., Kiev 54, 01601, Ukraine (ignnanu@geolog.freenet.kiev.ua)

The Boltysh meteorite crater (diameter ≈ 23 km) on the Ukrainian shield (Fig.1) was formed in Precambrian (~ 2,1 Ga) granites and has a classical complex structure. The geological setting of it have been studied in many rorks which were summarized by V.L.Masaitis [1]. The annular trough around central uplift (average diameter ~ 4km) is filled with predominantly glassy impactites (tagamites) to 230 m thick. The crater lake sediments overlie impactites and are represented by laminated siltstones, sandstones, claystones. They have nearly 400 m thick in the central crater area.

The data about the geological age of lower crater sediments were contradictory (K_1-P_2) as well as results of early K-Ar whole rock age determinations of tagamites (177-64 Ma) [2]. In [2] the first suggestion about possible formation of Boltyshka crater near or at the Cretaceous-Tertiary (KT) boundary was done. The age of the crater once more attracts attention due to results of fission track dating of its glassy impactites [3]: 65,04±1,1 and later new Ar-Ar determination confirmed this age [4] 65.17 ± 0.64 Ma..

The aim of this work is a specification of the Boltysh event age by biostratigraphic methods because it can not only be not less precise than isotopic ones but also because it gives direct information on geological position of this event to stratigraphic boundaries.

The endemic character of faunal relics in crater lacustrine sediments (mollusks, fishes) caused debates as to the geological age of the related relict-bearing rocks; whether it is Paleocene or Cretaceous [5]. The results of fossil botany and palynological determinations seem to be more reliable, indicated the Paleocene age of the Boltysh crater sediments. In particular, F.A.Stanislavsky [6] found in the core of well 1715 at the depth of 100-130 m from the cover of the crater lacustrine sediments (Fig.1) in sapropelite shale layers the relics of undoubtedly Paleocene age - *Hakea exulata Heer, Dryandroides antiqua Wat., especially Dryophyllum furcinerve Schmalh., D.curticellense (Wat.)*, as well as *Comptonia* of the same type as in Thanetian sandstones of the Paris basin.

In this work we studied the ejecta of the Boltysh impact crater which exist as relics of the blanket out of the crater hollow. The best outcrops exist near the village of Lebedivka (~ 25 km NW of the crater center) (Fig.1). The lower unit of breccia is disintegrated basement granites with sedimentary dykes. The upper part of breccia unit consists from the fragments of granites and other Precambrian basement rocks which cemented by sandy - clayley matherial. Among fragments are a minor amount (near 1%) of sedimentary rocks such as carboniferous sandstones, siltstones, cherts as well as glassy impactites.

In two analyzed fragments from outcrops of the upper layers of the breccia the foramenifera *Stensioeina emscherica Baryschn., Anomalina infrasantonica Balakhm*, were determined by L. Plotnikova as well as by S. Lulieva the complex of nannoplankton CC15 [7] zone *Lucianohabdulus cayexi*. This confirms a late Coniacian age of the rocks of these fragments.

We assume that if any later sediments were existed in the moment of the impact event, it could have been washed off during catastrophic displacements of loose ejecta and were involved in the filling of sedimetary dykes within the crushed crystalline basement rocks mentionred above. We studied the dike which was composed of inequigranular grained gravel-sandy-clayey sediments. In places its thickness is up to 0.5 m. It is filled with sandy material, which contain grains of granitic minerals (quartz, feldspar, biotite). Some grains show shock metamorphic features, such as PDFs in quartz, deformation bands in feldspars, and kink-bands in biotite. From the sandy fraction of the samples from the central zone of the dyke small fragments of cherty rocks were determined and studied for the presence of foraminifera. The following Maastrichtian foraminifera were found: *Neoflabellina cf. reticulata* (Rss.), *Stensioeiona cf. pommerana Brotz.*, *Brotzenella cf. praeacuta* (Vass.), *Cibicidoides cf. aktulagayensis* (Vass.), *C. cf. bembix* (Marss.), *Cibicides cf. voltzianus* (Orb.), *Bolivinoides cf. peterssoni Brotz.*, *Bolivina cf. incrassata* (Rss.), *Reussella cf.minuta* (Marss.), and *Globotruncana sp.*

The data on absolute time scale of Cretaceous marker-species abundances [8,9] allow us to date the described complex of Maasrichtian foraminifera from the youngest breccia fragments of ejecta by the time interval from 66.8 Ma (mass development of *Neoflobellina frequens*) to 65 Ma (disappearance of these forms at the KT boundary). This age range corresponds to the time of formation of the Boltysh crater. The lower age limit of the crater formation is determined by the Earliest Paleocene age of well stratified Luzanovka (Fig.1) series rocks, which overlie the ejecta. These strara are characterized by the macro- and microfauna of the corresponding age, as well as by calcareous nanoplankton of the earliest (lower) zone of the Paleocene NP1[10,11] dated at 65 Ma [8].Thus, the new biostratigraphic data give as the most reliable age of the Boltysh crater formation as 66.8-65.0 Ma.

This value agree with above mentioned new fission track [3] and Ar-Ar age determinations [4] .

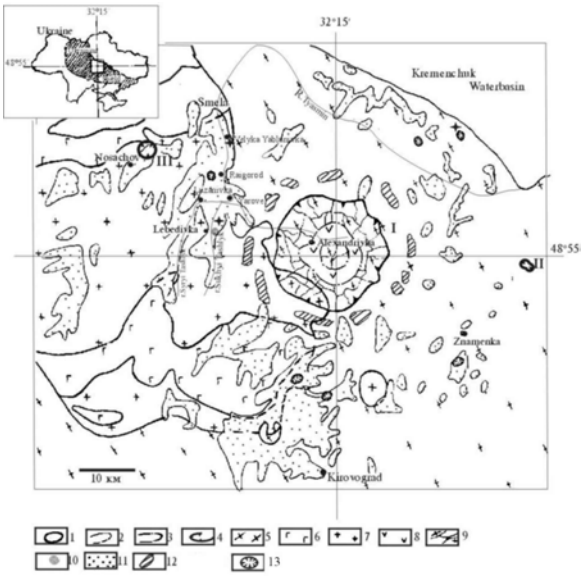

Fig.1. Schematic Geology of the area of the Boltysh impact structure . 1- geological margins; 2- the same, under sedimentary cover; 3- the same, within Boltysh impact structure area; 4- astroblemes: I – Boltysh; II – Zeleny Gay, III – Rotmistrovka; 5- Kirovograd granite; 6- gabbro; 7 - Rapakivi granite; 8- *tagamites and suevites of the Boltysh crater* 9 - impact breccia within the Boltysh crater; 10 - the point of finding of the ejecta breccia fragments with Upper Cretaceous fauna; 11- *ejecta out the crater*: sandy-gravel brecciated rocks, Paleocene 12- *annular concentric uplift (apx. 30- 50 m) of basement rocks outside the Boltysh crater;* 13 – suggested secondary craters.

A more definite answer to the question regarding the relation of the Boltysh ejecta to the KT boundary could be obtained in the future from careful studies of cross-sections of the adjacent parts of the Dneeper-Donets depression, using drill core studies.

References: [1] Masaitis VL (1999) *Meteoritics and Planetary Science 34, 691-711*. [2] Valter AA et al. (1984) *In: (Markov MS, Bazilevskiy AT, Katsura IK, Mukhin LM, Sukhanov AP – editors) 27th International Geological Congress 19 Comparative Planetology: 89-96. VNU Science Press, Utrecht, The Netherlands.* [3]. Kashkarov LL et al. (1999) *Solar System Research 33, (4),* 291-298. [4] Kelley SB and Gurov E (2002) *Meteoritics and Planetary Science 37*,1031-1043. [5] Bass YuB et al. (1967) *Geologia i ohrana nedr (USSR)*, 9: 9-15 (in Russian). [6] Stanislavsky FA (1968) Geologicheskiy Zhurnal (Ukraine), 28 (2): 105-110 (in Russian).[7] Sissingh W (1977) Geologie en Mijnbouw 56 (1), 37-56. [8] Berggren WA, Norris RD (1997) Micropaleonology, 43 (Suppl. 1): 17 -116. [9] Thierry Jakques et. al (1998) In: (De Graciansky P-C et al. - editors) Mesozoic and Cenozoic Sequence stratigraphy of European Basins. SEPM Special Publication,60.Tusla, Oklahoma, USA, 786 p.[10] Makarenko DYe (1970) Early Paleocene mollusks of the Northern Ukraine. Naukova Dumka Press, Kyiv, Ukraine,127 p (in Russian). [11] Moroz S A, Soloviak-Krukovskiy (1993) European Paleocene stratoregion of Luzanivka . Lviv University collection of articles of paleontology, 29: 65-72 (in Ukrainian).