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ABSTRACT We compared frequent snouted spherules from Carpathian Basin (Hungary, Roumania, Slovakia) and snouted spherules in Antarctica. We defined the "Pannon B" homogeneous spherule group (probably common origin) (We identified 2 other groups, genetically different, but analogous: one of them also of Carpathian Basin.) Result of comparison (Pannon-B/Antarctica): snouted spherules may have common origin, probably noncosmic.

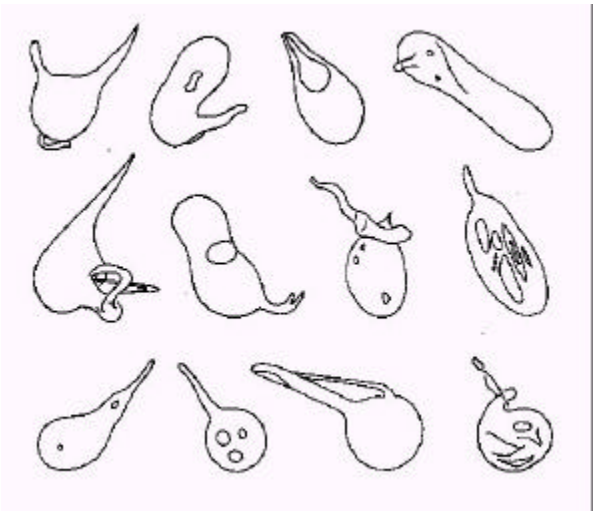
1. INTRODUCTION In the last 5 years several dozen spherule layers were identified in the Carpathian basin. Locality and geologic times were determined by drill cores [1-3]. But no real model about the origin of these spherules has been suggested because of their controversial character [2-3]. The main controversy is: several spherule layers (very different drill-core ages) contain apparently identical spherules [2]. We have found a far away counterpart (similar shape and composition) spherules from Antarctica, Dome Fuji [5-6]), for comparing all data, performing statistical analyses, to solve "mystery" of their origin. Our preliminary result is: chemical compositions of Carpathian Basin and Dome Fuji spherules are sufficiently different not to be in genetic connection. They both deviate into the same direction from "usual" spherule types. Their their main components projection on the cement industry material maps help to explain a probable way of origin.

2. THE CLASSIFICATION OF SPHERULES

Snouted spherulesbelong to Paraspherulites: "produced from terrestrial matter in terrestrial environment" (classification of [4]). Spherules of great extinction zones belong to Euspherulites: "formed when crossing the atmosphere downward". (Atmosphere crossing does *not* imply that Euspherulites would consist of extraterrestrial matter; in an impact most spherules come from the target local surface. But for Euspherulites the impactor is extraterrestrial. The 3 types of Euspherulites are: a) Meteoritic dust, b) mostly impactor, c) mostly target spherules. Each of them have "markers": chemistry, size, colour, shape for identification.)

3. CARPATHIAN BASIN & DOME FUJI SPHERULES

Two spherule types occurs frequently in Hungary [1, 3, 7-9]. Both: size range is ca. 0.2 mm, first found in NW Hungary. We call them **Pannon A and B**. Holotypes were suggested: For Pannon A: Magyarpolány Mp-42 (drill-core [10]). For Pannon B: Bakonyjákó-528 (drill-core [11], nearby localities). (Magyarpolány Mp-42 also contains Pannon B', [12] without chemical analDifferences between the two types: **Pannon A** is *magnetic*; spherical, some contains a void in center (some show blasting up), colour is black(ish), mainly iron oxide. (Further we do not discuss Pannon A.) **Pannon B's**, are *nonmagnetic*, glassy, translucent, average is light yellow. Shape: characteristic feature is the snout(s): long tendrils from droplets [12]. Dome Fuji spherules are similar to Pannon B-s, for appearance [5]. (size is ca. 0.2 mm, yellow, also snouted [13]). Fig.1 shows Pannon B spherules from **B**akonyjákó, **A**szófô & **V**érhalom-1, (shortly BAV).



4. MEASUREMENTS 23 BAV spherules (3 localities, 4 (?) (drill core) ages ([36, 2]) were measured [14]. (AMRAY 1830I electron microscope, with an EDS detector PV 9800, 15 kV, beam current 2nA, measurm. time 100 s. Standard samples: kaersutite, diopside, chalcopirite, synthetic Ba-glass.) All were glassy, Pannon B type spherules.

5. PANNON B SPHERULES AND THEIR RELATIVES

We defined Pannon B spherules by **holotype**, **locality, age**, **diagnosis**, and **description** [14] as follows. *Pannon B (nonmagnetic, glassy) spherules*: **Holotype**: The spherules of the drilling core of borehole Bakonyjákó-528 [11], chemistry [14-15, 2, 16-18]). **Locality and age**: Bakonyjákó-528, Bakony Mts. Hungary. (Age of drill-core: Santonian/Campanian.). **Diagnosis**: Homogeneous spherule group. Differs from most glassy spherules by the high Ca content ($CaO_{,}SiO_2$), differs from other high Ca spherule types as: more Mg, and more Ba, as in Nagylózs group [14] and as in Dome Fuji group [5]. **Description**: ***Pannon B: nonmagnetic, glassy spherules. Diameter: cca. 0.2 mm or upwards, shape:rounded, teardrop or elongated, with curved appendices ("snouts"). Colour: colourless, yellowish, sometimes light brown. Chemistry: Na_2O 0.42±0.04 %, MgO 8.8±0.4 %, Al_2O_3 9.3±0.8 %, K_2O 0.67±0.07 %, CaO 37±2 %, BaO 2.6±0.2 %, FeO 0.2±0.1 %.*** (for chemistry ± ranges denote 1 sigma stat.). This composition is strange. An impact spherule would be similar to either the impactor or the target area ([20]; (processes [21]). The chemical analyses were on Bakonyjákó-528 spherules, (2 groups: a) at 58.5 m., in marl, b) 80.5 m. in Csehbánya Formation [11], at Magyarpolány [12]), (mixture of marl, pebbles, sand and silt: difficult to compose above target composition, especially for high Ba), but such a high Ca/Si ratio is also unusual in spherules: even the Ca-rich fraction of Senzeilles (F/F) Ca/Si is only 0.75, while here is almost 1.5. If the spherules are from impactor, then their composition is quite alien from meteorites, perhaps with exception of Angra dos Reis [22], even Angra dos Reis contains substantial FeO (cca. 10 %) and less CaO; high Ba is example.

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Other Pannon B sites: 1) Aszófô, [8], 2) Vérhalom-1, [15], [2-3], 3) Sopron-89, [8], [23-24], 4) "Budapest", [8], [23-24], *Sites with spherules of similar appearance but without measured compositions:* I) Városmajor-1, [11], II) Balatonarács[3], III) Nekézseny[25], IV) Recsk-136, [3], *Analogous but distinguishable species*: **Nagylózs-1** [26-27], *Pannon B relatives in the Carpathian Basin: 1).* Piatra Craiului Mtn.(Királyerdõ) E.Carp. Basin (Roumania) [23], [28], 2) Northern Slovakia [29], *Analogon from Antarctica:* They are certainly recent; found in containers for melting snow for freshwater [5], [13]. **Dome Fuji spherules** [5] satisfy the Pannon B definitions - "sister taxa" -, but differ in composition, so same source is excluded. Chemistry data fall for both in narrow range, (except Ba), overall compositions show similar peculiarities. Averages, mean deviations: Na_2O 0.20±0.01 %, MgO 6.0±0.9 %, Al_2O_3 15.2±0.5 %, K_2O 0.33±0.03 %, CaO 38.1±1.7 %, BaO 0.08±0.01 %, FeO 0.32±0.03 %.

6. THE STATISTICAL ANALYSIS OF SOME DATA

From the data of [14] we determined averages, mean deviations, which were correlated [30]. SiO_2 strongly *anti*correlated with the other major components. Any theory for the type of correlation would need a definite idea about the formation processes of Pannon B, unavailable in this stage. We may assume distributions are not far from normal (sample sizes are small to verify this)[31].).

Results. 1) The two Bakonyjákó-528 samples (two layers in drill-core) cannot be distinguished. 2) The maximal Chi-square of any site from the average is 10.67 for degree of freedom 7, so the sites are not distinguishable. 3) “Budapest”, Sopron-89 spherules are undistinguishable, Nagylózs-1 group significantly differ.

7. AN ANTARCTIC PANNON B (OR B'): DOME FUJI

Dome Fuji spherules in narrow chemistry distribution and glassy nature are similar. (Recent analysis on 5 spherules [38]). Statistically all three differ significantly (Nagylózs-1 is middle between Pannon B and Dome Fuji.) Ca is for all three is identical. Pannon B/Nagylózs-1 are similar in Na and Al too, Dome Fuji is poorer in Na but richer in Al. Nagylózs-1/Dome Fuji are very similar in Mg, contrast to Pannon B. (Ba in Pannon B-s is very high, in Nagylózs-1 some fifth, high too, Dome Fuji Ba is "normal".)

8. DISCUSSION ABOUT ORIGIN We draw crude conclusions. Problem is the great chemical homogeneity of Pannon B spherules, their "recurrent in time" (from drill-core ages:4 drill-core ages: Miocene, Santonian, Campanian, Anisian, Norian.) Their chemistry is "improbable", high Ba content point to a very special formation process.

Kákay-Szabó [23-24] suggested lunar origin. The composition is not lunar, no explanation on the lacking of Pannon B-s outside Hungary. She is right: all such spherules may have common origin. We now shortly follow the scenarios how to generate them. A**re they impact of extraterrestrial origin?** Then, impact was not planetwide; (from size of Hungary we guess: projectile was smaller than Ries Crater former, so <1 km.) Only Angra dos Reis is superficially similar, (if compared: Pannon B is very poor in Fe and very rich in Ba: no probability of such a strange large meteorite.).**Are they spherules of the target?** The target could not have been so homogeneous at 4 places separated by 200 km, during 150 Myears. We do know that including layers are different; but Nagylózs site is in the neighbourhood with distinguishable spherule composition. Extraterrestrial origin does not explain the facts. Then there remains a ***completely* terrestrial origin**. No complete theory of terrestrial formation of spherules is yet. But how could a mechanism produce same strange spherule compositions (lack of Fe; abundance of Ba) in the far past at a variety of sites *and* times. **We conclude: Explanation is easier if either times, or locations (preferably both) were artifacts**. (*not* arguing for this; we need something more positive than the lack of explanations [2]. To this one important idea was suggested by **Dome Fuji spherules.** ***They are clearly recent; and the main problem was recurrence***. If Pannon B's are recent too, then there would be easy to find a source. **CEMENTS?:** Apart from Ba Pannon B,/Nagylózs/-Dome-Fuji group chemistry is compatible with cement powders. High Si and Ca content with moderate Mg and Al, (Fe removed) is characteristic for cements. Projection of Pannon B and related spherules to the SiO_2 - CaO (+MgO) - Al_2O_3 system. [38-39] show this similarity, especially to blast furnace slag cements. Cement powder is abundant in the atmosphere, and its occurrence is probable even above Antarctica. But how recent cement powder could invade drill cores, (no Aszófô: it is surface exposure) stored for long times. Contamination from *laboratory* ceiling [8] was suggested, verification was unsuccessful. Aszófô spherule compositions significantly differ from laboratory ceiling in Gif-sur-Yvette [8]. Aszófô spherules were measured in Hungary in 1996 [2, 15], with essentially the same results as [8]. So the existence of Pannon B as a homogeneous spherule group is established. The problem of origin can be solved in the future.

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