Special Issue:
Baszkówka Meteorite — Messenger from Space

FOREWORD

The landing of a meteorite in the sunny afternoon of the 25th August 1994 near the hamlet of Baszkówka by Warszawa was an important and extraordinary natural event, inasmuch as that the number of the meteorites fallen and found in Poland is small, and the previous observed landing of the mesosiderite Łowicz took place almost 60 years ago. The landing near Baszkówka was observed, the stone was immediately collected and after few months became the pride of the Museum of the Polish Geological Institute in Warszawa. The epithet "pride" is particularly meaningful because it is an exceptional rarity in world museum collections — an impressive, well-proportioned, oriented stone almost entirely covered with a fusion crust and deep regmaglypts. Further laboratory studies demonstrated the peculiarities of composition, the originality of the structure and the puzzling development of the planetary matter that the Baszkówka meteorite is composed of.

Baszkówka belongs to the group of chondrites: meteorites that are composed of partly altered, but not evolved matter, and so carrying information on the earliest stages of our solar system's formation and additionally bringing much information on planetary matter development. The name "chondrites" derives from the term "chondrules" (Greek: hondros grains). Chondrules are small silicate pellets (the main component of chondrites), whose origin remains the one of the biggest enigmas in cosmogenesis. Chondrules and calcium-aluminum inclusions (CAIs) hold the most important indications of the flash melting and rapid cooling of the dust in the protoplanetary disk; the cradle of the Sun and the planets. The abundance of chondrules in planetary matter suggests that flash melting and rapid cooling were widespread processes active before the accretion of the meteorites parent bodies.

Chondrules and their precursors were the principal subjects of two international conferences, the first in 1982 at the Lunar and Planetary Institute in Houston (Chondrules and their Origin), the second in 1995 in Albuquerque (Chondrules and the Protoplanetary Disk, Cambridge Univ. Press, R. H. Hewins, R. D. Jones, E. R. D. Scott, Editors, 1996). In conclusion, the term chondrule is restricted to the definition: "...the majority of chondrite ferromagnesian silicate particles that are assumed to have formed by a common process; it includes fragmented as well as complete melted spherules, and similar objects which lack a droplet form because of incomplete melting, but excludes particles of other compositions, e.g. calcium-aluminum rich or refractory inclusions (CAI) and basaltic fragments, as well as melts spherules found in impact and volcanic deposits (op. cit.). "The Conference in Albuquerque sought to discover whether studies of chondrules could furnish any information on the nature of processes operating in the solar nebula; and whether some astrophysical models could explain the origin of chondrules. The problems of the chondrules' precursors, and the time and conditions of their melting were discussed. Some kinds of shock waves and the dispersion of kinetic energy in friction were considered as the most probable sources of the heat, although giant electric discharges (nebula lightning) were also seriously taken into account.

At present the most usually accepted concept for chondrule origin is the solidification of silicate melt droplets ejected into interplanetary space as planetesimals collided. The first planetesimals accreted in an early stage of the solar systems formation; they then accreted into larger bodies which grew to some 30–100 km in diameter. The decay of abundant short-lived radioactive isotopes, mostly ^{26}*Al, furnished energy sufficient to heat the interiors above their melting point. During the collisions and fragmentations of partly-melted bodies huge swarms of incandescent droplets were ejected, which froze in minutes or hours and transformed into chondrules. However, these planetesimal impacts involved not only melted cores but also many solid fragments of the exterior shells, which were ejected into space. Solid fragments and melted droplets agglomerate' building new planetesimals and asteroids. Remnants of such agglomeration are observed in the Baszkówka and in other meteorites.*

In large primitive bodies, whose diameter was over 100 km, the differentiation resulted in separation of a heavy metallic core and a light, mostly silicate mantle, as in the early history of the Earth. Fragments of such smashed bodies are found at present as iron meteorites and achondrites — products of the differentiation of melted chondritic matter.

Every day the surface of the Earth receives into about 100 to 1000 tons of planetary matter, of which only a small part of one percent is found. Most of this matter falls into water or in uninhabited regions, often in the form of microscopic dust particles. Observed falls of a meteorite, as was the case with Baszkówka, furnish a precious sample for investigation and become an object of common attention, furnishing at times unexpected data. For example, halite and sylvine, soluble chlorides crystallising from aqueous solutions, were found in the Monahans chondrite which fell on March 22, 1998; could they be present also in Baszkówka?

A key feature of the Baszkówka chondrite is its similarity to the Mt. Tazerzait chondrite and a few other chondrites that fell over a substantial time span and in widely separated places. However, in spite to these differences in the timing and place of falls, there is good evidence that this group of meteorites may have originated from the same parent body.

This volume of the "Geological Quarterly" is devoted to publications on meteorites and related problems. These studies were sponsored by the Committee of Scientific Research (Projects no: 6 PO4D 031 and 6 PO4D 061 18), and the volume mostly comprises the results of five years' study of the Baszkówka chondrite. Other papers discuss some related questions in meteoritics, including means of discerning meteorites from artifacts.

Nowadays there is a growing interest in meteorites in Poland; but publications on this topic are hard to find in this country. The authors and editor of this volume intended, as far as possible, to fill this gap.

The present volume is a collective effort. Firstly, one must mention H. and K. Grodzki, who found and excavated the Baszkówka meteorite and kept it in good condition, and H. Sobczyk, who initiated the transfer to the Geological Institute. The realisation of the researches would be impossible without the support, help and participation of Professors: A. Manecki (University of Mining and Metallurgy, Kraków), R. Dybczyński (Institute of Nuclear Chemistry and Technology, Warszawa), and S. Hałas (Maria Curie-Skłodowska University, Lublin). J. Borucki too, assisted and participated in the preparation and realisation of the projects.

The study of Baszkówka was coordinated from the Polish Geological Institute, where most of the analyses were made, with the participation of other Polish institutes. The considerable participation of foreign scientists should be underlined: F. Wlotzka, L. Schultz and P. Scherer — Max-Planck-Institut für Chemie, Mainz; J. Otto — Universität, Freiburg, Germany; I. Franchi — Open University, Milton Keynes, UK; M. Funaki — National Institute of Polar Research, Tokyo, Japan; S. Maruyama — Okayama University, Japan; K. Tanida — Nippon Instr. Corp., Osaka, Japan.

The editor warmly thanks to all these and other co-workers and co-authors for the rescue and study of this unusual messenger from space, and finally for the hard work in the preparation of this volume.

Marian Stępniewski

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Baszkówka meteorite