Was ist Das?

by Walter Zeitschel

The accompanying photographs are of a 286 gram Sikhote-Alin individual. On one side of the specimen you can see unusual larger and smaller "craters". I have examined hundreds of Sikhote-Alin specimens before, but this is the only specimen exhibiting such features. No one seems to have any idea how these craters were formed.

Sikhote-Alin 286 g individual, with the craters circled.

The opposite side showing typical regmaglypts.

A close-up of crater number 2.

[Editor's note: If any readers of Meteorite! have some plausible explanation for these craters, please forward it to us for publication in a future issue].

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DOWN TO EARTH

Usually this editorial focuses on items of interest in the current issue, and as always there are many such again. But it is with a deep sense of regret that we bring you the News item on page 7 of the alleged theft of meteorites from a museum in Brazil by the well-known meteorite dealer, Ron Farrell, of Bethany Sciences, and an associate. The specimens involved were reported to be the Angra dos Reis (fell 1869: augite achnondrite, donated last century to Dom Pedro II, the 2nd Emperor of Brazil), and two pieces of Serra de Magé (fell 1923: Ca-rich eucrite).

Such allegations cast a pall over the whole field of collecting and serve to weaken the bonds between collectors and the scientific community. To most collectors, meteorites are sacred objects bestowed upon us from space, and held in great reverence. In fact, most are willing to pay dearly for the privilege of owning such unique objects. Their study is endlessly fascinating and enriches our lives and advances our understanding of that corner of the universe we live in.

But to steal what has been sent to us by the gods, is despicable. May we never have to report such an event again.

On a more positive note, in view of the confusion surrounding Gao/Guéné (see below), we have arranged with Dr. Wayne Walton of Burkina Faso, to supply definitive samples of each meteorite to Alan Rubin of UCLA for analysis.

LETTERS

Sir, Concerning the "crater" holes in the individual Sikhote-Alin specimen ("Was ist das" Meteorite Feb. '97), I believe that the craters were formed by spherules that were produced by the ablation of another larger sample.

The Sikhote-Alin meteorite was fragmented in the air at a low altitude. Then atmospheric sorting took place - large fragments went ahead and the more highly decelerated little ones remained at the rear. In such order they reached the ground. During their passage through the atmosphere all samples were ablated. Their surfaces were heated and melted by air friction, and then the air stream removed the melted material which cooled as droplets, forming little spherules that were parts of a millimeter in diameter. These extremely small particles were quickly decelerated. They were found in the Sikhote-Alin soil during various expeditions there.

If any individual that has not lost its velocity flew through a cloud of ablation spherules produced by a preceding large sample, it would get traces of the impact by the spherules on its surface that would look like little craters. Naturally, the craters are formed on the front surface only as can be seen in Mr. Zeitschel's photos. This surface may still be in a plastic state during crater formation. There cannot be a great abundance of this kind of sample because most of the little individuals were decelerated before they reached the zone where they can get craters. I am sure that the described sample was found very near the Sikhote-Alin crater field or directly on the crater field.

Valentin Tvaroukho
Institut des Sciences de la Terre, Paris

Sir, I am also much confused about Gao/Guéné. In fact, I am not convinced that these are two different meteorites. My colleagues M. Bourrot-Denise and M. Christophe together with a geologist from Burkina Faso, U. Wemenga, just sent a short report to Meteoritics & Planetary Sci. on a comparison study of a few samples labeled Gao and Guéné. Their conclusion is that from the petrological point of view, there is nothing against these being the same meteorite. The different rare gas concentrations found in some samples can be explained if Gao/Guéné was a big meteoroid and it was certainly so, given the mass now collected.

Claude Perron
Museum National d'Histoire Naturelle, Paris

Sir, Regarding the "Three Falls in Upper Volta" (Meteorite Nov. '95) and "Gao, Guéné, Souma - Chutes Réelles ou Imaginaires?" (Meteorite Feb. '97), I now find myself thoroughly confused. I have no idea if any two specimens, supposedly a Gao and a Guéné, are actually both Gao, or both Guéné or what? I would love to see side by side comparison photographs of two or three representative samples of each in a future issue.

Don Latino
East Lee, Massachusetts

Sir, With reference to the article by Richard Norton in the May 1997 issue, readers may like to know that the image published in our book The Origin of Comets (Bailey et al., Pergamon 1990) and, in color, in Physics World (February 1993, p. 22) is identical to that shown both in the frontispiece to Kronin's book Principles of Meteoritics (Pergamon 1960) and Kronin's article in The Moon Meteorites and Comets. It is the same as that seen and photographed by Mikhail Petsev, and presumably has the same heritage: the Meteorite Committee of the former USSR Academy of Sciences. Our image came from the Chair of the Meteorite Committee in 1988; it is clearly different from the reproduction shown to Peter Franken, though both paintings show the fall as occurring from top left to bottom right.

Mark Bailey, Armagh Observatory

Sir, Richard Norton's excellent article on microscopy (Meteorite Feb. '97) will surely encourage readers to look into the prospect of building up a collection of thin sections. The real stumbling block is that a good quality, suitable microscope costs a small fortune. There is, however, a much cheaper alternative.

Try to get hold of a microfiche reader. They can be purchased for as little as $170 new, and $65 or less, used. By removing the cover glass the machine can easily be adapted for viewing thin sections. And it is a relatively easy matter to insert polarizing filters. Microfiche readers are often advertised in genealogy magazines, and some libraries are beginning to replace readers with PCs, so you could pick up a bargain.

Piotr Bagnall
Northumbria, U.K.
SMALL IMPACT CRATERS ON SIKHOTE-ALIN IRON METEORITE SURFACES

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Introduction: Existing reports of the abundant and well studied Sikhote-Alin Iron meteorite attribute delicately preserved surface features to aerodynamic sculpturing, effervescence of volatile components, or plucking of xenoliths. Newly available individual and fragmented irons occasionally display single, round-floored circular depressions with high-relief rims. We interpret these features as impact craters sustained during the last moments of a specimen in flight.

Background: On the clear, cold morning of 12 February 1947, a brilliant fireball was seen over the Sikhote-Alin Mountains of eastern Siberia and, in less than ten seconds, more than 50 tons of iron meteorites slammed into uninhabited, snow covered taiga forest. Formal expeditions began arriving almost immediately so that, over the next several years, more than 100 impact pits and craters have been charted, more than 30 tons of pristine irons have been collected, and a uniquely preserved, bountiful collection of cosmic material has become accessible for systematic scientific scrutiny [1,2].

Breakup and Fusion: The original Sikhote-Alin Iron bolide, a coarsest octahedrite, began fragmenting high within the atmosphere along weaker internal planes defined by crystal boundaries. Recovered specimens occur mostly in three distinct geomorphic forms: larger masses bounded by recognizable geometric planes and usually with defined regmaglypts, twisted and jagged, shrapnel-like fragments with occasional regmaglypts or partial fusion crusts; and most commonly, small, irregularly shaped individuals completely sheathed in a distinct high-gloss metallic fusion crust. Fusion crusts on all geomorphic forms commonly are decorated with delicately sculptured patterns which include swirls of grooves and ridges, adhered or “spattered” metal beads, patches of scoraceous froth and bubbles, and occasional pits or shallow holes with angular walls. A thick ground cover of snow, estimated to be at least 60 cm deep during the impact event, has been credited with cushioning the impact landing of smaller pieces and preserving their delicate surfaces.

Most of these features are readily attributed to processes accompanying high-velocity atmospheric flow: erosion of weaker components, frictional heating, volatilization, and plucking of single crystals.

Fig 1. A small whole individual Sikhote-Alin iron meteorite with well developed fusion crust and a solitary 8 mm diameter impact crater on its surface.

Impact craters: During an examination of newly available, small (ca. 100 g) individual and fragmented Sikhote-Alin Irons we have observed an unreported type of surface morphologic feature. Solitary, round-floored circular depressions 1 - 8 mm in diameter and ringed by high-relief rims occur on fusion-crusted individuals and on at least one shrapnel fragment. We interpret these features as impact craters resulting from high velocity collisions between meteoritic particles during the latest stages of atmospheric flight. Although crater-like bubbles might develop within a fusion crust, during skin heating by atmospheric friction, craters emplaced on fusion-free shrapnel fragments had to have formed later, after atmospheric penetration had already violently disrupted a larger body.