RIAP BULLETIN

Volume 5, Number 1–2 January—June 1999

Research Institute on Anomalous Phenomena (RIAP) is an independent scientific research body, established in 1992 by the Kharkov-based aerospace company *Vertical* and aimed at scientific studies in the fields of non-traditional energy sources, the problem of anomalous atmospheric phenomena and the SETI (Search for Extraterrestrial Intelligence) question.

*We study:
anomalous phenomena.
We consider:
any theories.
We accept:
normal proofs,
exact references.*

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Published Quarterly by Research Institute on Anomalous Phenomena
P.O.Box 4684, 310022 Kharkov-22, UKRAINE
Printed and Distributed by Frontier Sciences Foundation
P.O.Box 372, 8250 AJ Dronten, THE NETHERLANDS
Website: http://www.f-s-f.com/

SCIENCE AND ANOMALISTICS

This RB issue deals with three different subjects: the famous — at least in Russia — Vashka find as a possible extraterrestrial artifact (paper authored by V. N. Fomenko — the first technical report of this investigation ever published in any language), the enigma of the Tunguska meteorite (paper by S. V. Dozmorov), and the problem of paleovisits — ancient ET visits to the Earth (a review by Y. N. Morozov of two issues of the *Scientific Ancient Skies* journal).

The main common trait of these themes is their off-mainstream position in science, even if not identical in every case. The Tunguska explosion of 1908 has produced a lot of publications in scientific journals; the *theoretical* possibility of paleovisits is generally admitted by SETI specialists; ET artifacts are considered by scientists as the only possible proof of direct interstellar contacts. At the same time, each of the above-listed problems has an essential anomalous component, especially where concrete empirical investigations (and not just theoretical considerations) are concerned. It seems as if mainstream science deliberately pushes them out, carefully forming a gap between itself and "uncomfortable" questions to which scientists have no definite answers. In this way another sphere of human thought is however enriched, namely anomalistics.

Generally, anomalistics is an open expression of doubt (and sometimes of irony) in respect to constantly renewing pretensions of man to learn the final truth. But what is it from the viewpoint of the philosophy of science? Certainly, anomalistics cannot be called a scientific discipline. The lack of common methodological standards (apart from doubt) prevents it from being named even as an interdisciplinary area of scientific research. As a matter of fact, it is rather a loose *field of cognitive interest*, whose foundations were laid by Charles Fort, and which has gradually evolved, due to work of many enthusiasts all over the world, into something substantial. Just as the scientific community is the heart of real science, the "anomalistic community" with its researchers, associations, periodicals and data arrays (even systemized, particularly, in the works by W. R. Corliss[1]) constitutes anomalistics as an actual socio-cultural system in its own right. Of course, this system cannot be compared with science as far as its influence on the society is concerned, but nonetheless it dares to criticize some sides of the scientific picture of the world.

However, there exist not only "negative" interrelations between science and anomalistics, but "positive" ones as well. The latter pay attention either to those (intra-scientific) anomalies which science tends to neglect, rating the safety of a current paradigm above these minor problems, or those (extra-scientific) anomalies which are not incorporated into science at all. Anomalistics tries, with varying success, to have these facts absorbed by science, not worrying too much about the possible results... In other words, serious anomalists are not inclined to substitute science for anomalistics. The latter is rather meant to be a mirror for "scientific drawbacks", a reproaching gaze and a moralizing sermon from the empyrean of the "epistemological ideal" of science (where the only aim is scientific truth) to the bottom of its social reality, where the scientist not only perceives the laws of nature, but maintains thereby his family and himself.

It is significant, however, that a response to this reproach comes rather from off-mainstream ("alternative") science than from "normal" science. This fact hardly can be enigmatic, though. When compared to normal science, the alternative one does look much more "altruistic". It *has* to be more altruistic — conducting investigations *in spite* of the lack of necessary funds. It is therefore alternative science that preserves under current social conditions the early ideal of the "disinterested quest for truth" placed by mainstream science at a literally unattainable height.

The late Dr. Sergey Dozmorov (he died a few years ago having accidentally poisoned himself in his laboratory) was performing his studies of rare earth contents in Tunguska samples in his spare time; after his death the samples were thrown away by his colleagues as having no value for the regular studies the laboratory was engaged in. Tunguska investigators (especially those associated with IITE — the Interdisciplinary Independent Tunguska Expedition[2]) are not fanatics at all — but their aspiration for truth is certainly above the average level.

This aspiration manifests itself, particularly, in their noticeable reluctance to jump to conclusions regarding the nature of the Tunguska Space Body (TSB) too soon. In fact, the longer one studies this problem, the better (as a rule) he or she understands its complex character. Unfortunately, some representatives of big science prefer to live in the refined theoretical clouds, practically ignoring the "crude" factual data. Compare, for example, such directly opposite models of the TSB as the hypothesis about the "cosmic snowflake" (put forward by G. I. Petrov and V. P. Stulov[3]) and the conception of a black hole (proposed by A. A. Jackson and M. P. Ryan[4]). Both these models are as rigorous as professional mathematical calculations can be. But at the same time they are as naive as should be the same calculations when they are based on a very limited factual evidence. Meanwhile, the amount of reliable information on the traces of the Tunguska explosion is very considerable, and any theoretical constructions which ignore it may be regarded at best as a play of mind.

Naturally enough, specialists in meteoritics have been treating the work of IITE with some reservations. These reservations are, I would say, even justifiable: either the TSB is a normal minor body from space (a meteorite, an asteroid, a comet), in which case it is meteoritics that must study its fall, or the TSB is something different, and then meteoritics remains just one of the disciplines involved in the investigation, being at best responsible for elucidation of some aspects of the TSB movement in the atmosphere. Hence, the "transfer" of the problem from the Committee on Meteorites of the USSR Academy of Sciences to IITE in the early 1960's was a very far-seeing step. Whatever the leading Soviet astronomers wrote in popular-science journals, this fact suggests that "for themselves" they solved the question of the TSB nature almost 40 years ago: the Tunguska "meteorite" is a sheep from another flock, it is essentially anomalous.

Should such anomalous phenomena be studied using anomalous methods? Sometimes maybe yes, but only if the latter have been verified in normal scientific investigations — otherwise we will have no solid ground under our feet. For example, so-called "biolocation" (dowsing), being used by some Russian ufologists to investigate UFO landing sites,[5] does not satisfy this requirement, producing therefore no data of scientific value. By contrast, the results of the investigations of supposed ET artifacts, performed by V. N. Fomenko, may be discussed (criticized, or not) inside the scientific community not generating any principal objections.

Here we can notice what may be called the gradual mutual approach of science and anomalistics. Each of these cognitive systems may benefit borrowing from experience of the other one. After all, the Tunguska event would have been probably completely forgotten decades ago if it had not been reanimated in the ET hypothesis of Alexander Kazantsev. By the way, it was none other than the latter author who, immediately after the Vashka find was discovered and examined, assumed it could be a fragment of the Tunguska meteorite. Hardly so (as one can read in the paper by V. N. Fomenko, the age of this find seems to have been by the time of its examination less than 30 years), but the idea is not absurd in itself. The "rare earth parallel" between these objects may happen to be of significance.

Publications in *Scientific Ancient Skies*, reviewed by Y. N. Morozov, also aim at "scientization" of the problem of paleovisits. Forty years ago, in 1959, Soviet mathematician Dr. Matest Agrest put forward the paleovisit idea as a scientific hypothesis. The learned community did not accept his considerations and the idea was practically pushed out from science. Now it gradually returns. Contrary to the widespread opinion, even such an extraordinary claim as the paleovisit hypothesis does not need an extraordinary proof — it needs a proof which would be serious, scientific, deeply normal.

As a matter of fact, there is no alternative science — but there exists *normal* science (living, advancing, broadening its sets of methodological, theoretical and empirical tools — and surmounting the narrow-mindedness, not foreign to individual scientists and entire scientific communities), and there also exists *abnormal* science of many types — from socially-dependent ("Aryan", "Marxist", etc.) to, let's say, "too much established". Admittedly, real science combines at each stage of its development both "normal" and "abnormal" components. The former ones contribute to the advancement of science, the latter retard it, but it does not always happen that the latter can be clearly separated from the former. To err is human; scientific communities are also human-based systems.

When "big science" digresses in its practice from its own ideal of objective cognition, it becomes abnormal and loses its right to call itself "science"; when "alternative communities", more or less loosely connected with "big science", maintain in their work this ideal, they obtain the right to be called "scientific", without such restricting epithets as "alternative".

Ideally, science and anomalistics should comprise a single cognitive system — only then anomalies would be studied and neither ignored nor discredited. Being separated, they lose more than half of their potential strength. Hopefully, the papers published in this RB issue will contribute to some progress in this direction.

Notes and references

[1] See: http://www.knowledge.co.uk/frontiers/

[2] See: *RIAP Bulletin*, 1994, Vol. 1, No. 3–4, p. 2.

[3] Petrov G. I., Stulov V. P. Motion of large bodies in planetary atmospheres. — *Kosmicheskiye Issledovaniya*, Moscow, 1975, Vol. 13, No. 4, pp. 587–594.

[4] Jackson IV A. A., Ryan M. P. Was the Tungus event due to a black hole? — *Nature*, 1973, Vol. 245, No. 5420, pp. 88–89.

[5] See, for example: *Studies of the Problem of Anomalous Phenomena in the Environment*, Kharkov, 1990, pp. 17, 24, 41.

— Vladimir V. Rubtsov

THE VASHKA FIND: RESULTS OF AN INVESTIGATION

V. N. Fomenko*

1. The facts of the case

This fragment of a metallic object, as big as a man's fist, was found on May 10, 1976, on the bank of the Vashka river (a tributary of the Mezen river that flows into the White Sea), some 10 kilometers from the settlement of Ertom (Udor district, in the then Komi Autonomous Soviet Socialist Republic). It was discovered by three workers who lived at the settlement and came to the site to fish. The fragment lay on a shingle-bank near the water. It attracted the workers' attention by its white glitter. When dropped onto stones, the object produced a shower of sparks.

Being much impressed by their discovery, the workers took the find to Ertom and cut it into three pieces with a hack-saw, so as to share the fragment between themselves. During this process, fire spurted from beneath the saw blade.

In the winter of 1977, a team of geologists came to Ertom from Syktyvkar (the capital of the Komi ASSR) and one of these three pieces was given to a member of this team, V. M. Polezhayev. The latter asked Professor N. P. Yushkov (Institute of Geology, the Komi Branch of the USSR Academy of Sciences) to analyze the piece. The results obtained proved to be strange indeed: although laser qualitative spectral analysis indicated its substance to be an alloy consisting of magnesium, iron, manganese and molybdenum, this alloy, according to its X-ray diffraction spectrum, had no crystalline structure. But no existing technological method can produce amorphous metal films any thicker than 1 micrometer (10^{-6} meter)...

Three years later, rumors about the unusual find reached some Soviet amateur ufologists who supposed it could be a fragment of a UFO. G. V. Sorokin, living in Petrozavodsk (Karelian ASSR), obtained from N. P. Yushkov a piece of the find that was in its turn cut with a diamond circular saw into six pieces at a laboratory of the Leningrad Institute of Physical Technologies. Five of these were passed on to various Leningrad scientific research bodies. In October 1980 a sample shaped more or less like a parallelepiped, weighing 16.05 grams, with a volume of 2.69 cm^3 and measured some 2 cm x 1.5 cm x 0.9 cm was given to the present author for investigation.

* *Note by the Editor:* The interested reader will have an opportunity to know about interesting ideas and findings by the author in his book *Technology of Miracles* that is to be published this year in Russia.

Table 1. Chemical composition of the sample

Measurement	Ce	La	Nd	Fe	Mg
I	74.71	10.87	6.95	3.90	2.27
II	75.25	10.99	6.83	4.43	2.04
III	75.58	10.92	6.85	5.22	2.05
Average	75.18	10.93	6.88	4.52	2.12
Spread in values	0.64%	0.64%	1.16%	1.57%	6.57%

The sample was studied at the institute where I have been working (then Scientific Research Institute No. 125, now the "Soyuz" Federal Center of Dual-Purpose Technologies), as well as at some other Moscow research institutions. Its composition, properties, and technology of manufacturing proved to be unusual indeed.

2. Results of the studies

2.1. Chemical composition of the sample

First, the composition of the sample was determined by analysis of the X-ray emission spectrum induced in the substance by a beam of electrons using a scanning electron microscope *Microscan–9* (manufactured by the British firm *Cambridge Instruments*). Its surface formed when the initial find had been cut was polished and then the sample was placed and stored in kerosene (since in the air it oxidized rather swiftly). Just before placing it into a vacuum chamber, the surface was polished with diamond paste.

To select points where the composition of the alloy was to be determined, this surface was scanned at a 7000× magnification, while recording X-ray photons emitted when atoms of the sought-for elements were bombarded by electrons. We found that more than 90% of the surface was uniform in composition, having no boundaries between crystals, neither voids nor impurities, and being therefore suitable for analysis.

The instrument was calibrated using standard high-purity (0.999 – 0.99999) metals. Besides, the built-in computer introduced corrections for mutual shielding, absorption of electrons and X-rays by the alloy components (using three iterations), as well as for fluorescence. The results obtained are shown in Table 1. The figures represent the percentage of each of the five metals that constitute together 99.61% of the whole *number of atoms* in the alloy.

Apart from the main components, there were found in the homogeneous phase of the alloy 0.39% of impurities. Among those the most noticeable proved to be uranium and molybdenum (each of them accounting for 0.04% of the substance).

Although the areas where the composition of the substance was determined were very small (7 x 7 micrometers each), only a light scatter in the data was noted. This result testifies that no crystals of the order of a few micrometers in size (or bigger) exist in these areas.

In other Soviet scientific research bodies (Moscow Physical Engineering Institute, All-Union Institute of Nuclear Geology and Geophysics, some research institutes in Leningrad and Syktyvkar) attempts were also made to determine the composition of the alloy with spectral and mass-spectral methods, the findings of the investigations being somewhat different. However, in these cases the test areas were selected just by chance, being as a rule not cleaned of surface contamination, oxides, hydrides and other components swiftly formed when the surface of the sample came in contact with boxes, tables, atmospheric air and hands of the researchers. Besides, the test areas, from which the metal was evaporated by the laser beam, in these experiments were too large: about one square millimeter each. As a consequence, there was evaporated and analyzed a mixture of the homogeneous phase and inhomogeneous one whose composition fluctuated unpredictably. When the laser beam affected the same area repeatedly (to clean the surface burning out the impurities), the cleaned surface proved to be enriched with refractory and hard-to-evaporate components, which resulted in deviations from the true composition of the substance, as compared with the method used in the present work.

A. I. Raudin has also investigated the emission spectrum of the plasma formed under the influence of a laser pulse of 800 Joules energy. This experiment has confirmed (in a qualitative sense) that the sample consists of the elements determined in our analysis. Of special interest is, however, the lack of the spectral lines of calcium and sodium. Usually, when the concentration of these elements in a substance exceeds 0.00001–0.0001 %, these lines are the most distinct in the spectrum. To check if the equipment was working properly, the spectra of standard samples of cerium, lanthanum and neodymium were obtained. Purity of these samples reached 0.999 and 0.9999, being guaranteed by such methods of separation and purification as extraction, ion exchange, iodide refining, electrolysis, zone melting, fractional crystallization, and vacuum distillation. Nevertheless, the bright lines of calcium and sodium immediately appeared in the spectra. In fact, this could never have been avoided, since the chemical technology of the rare earths' production is based on a specific process: first, these elements are extracted from the ore in the form of oxides, and then they are deoxidized by calcium and sodium. That is why traces of the latter elements remain even in samples of the highest purity possible. The lack of such traces in the Vashka find proved to be the first hard evidence of its anomalous character. This alloy does seem to have been made with a technology that is foreign to our civilization.

Table 2. The content of isotopes of magnesium in the Vashka find (in %).

Measurement	^{24}Mg	^{25}Mg	^{26}Mg
I	75.2	11.0	13.7
II	79.4	8.86	11.9
Average	77.3	9.93	12.8
In the Solar System (according to A. Cameron)	78.6	10.11	11.29
Discrepancy, in %	1.3	0.18	1.51

However, to be on the safe side, I consulted specialists working at the Institute of Materials Science, in Podlipki (now the city of Korolyov, Moscow Region). There I was told that such an alloy was never used (neither could have been used at all) to make large components in rocketry and space engineering. The fact that trajectories of the carrier rockets fired from the Plesetsk launching site pass over 150 km to the north of Ertom is therefore a pure coincidence. I have also contacted the Laboratory of Rare Earths (Institute of Rare Metals, Moscow) — with the same result. Alloys of the same or approximate composition of the Vashka find were unknown to them, and they did not know for what purposes this alloy could serve. The whole set of publications on rare earths collected in the Lenin Library (now the State Library of Russian Federation, Moscow) was nonetheless carefully studied — again in vain. From time to time I discussed this question with specialists of various research institutes up to 1991, receiving the same answer.

2.2. Isotopic composition of the sample

M. M. Potapov and V. P. Kostiuchenko have determined the isotopic ratio for magnesium contained in the Vashka object. They used a mass spectrometer *EMAL*, in which atoms evaporated and ionized by a laser flash were accelerated by an electrostatic field and masses of the ions were judged by the duration of their flight to the anode. Unfortunately, the parameters of isotopes of lanthanum, cerium and neodymium were superimposed on one another, making it impossible to compare their isotopic ratios with terrestrial ones. But all three of the isotopes of magnesium (^{24}Mg, ^{25}Mg, and ^{26}Mg) were examined and the results are presented in Table 2.

The discrepancy proved to be within the experimental error of the device and method used.

Two years later, the isotopic ratios were checked with much better accuracy with special equipment that had been designed to analyze lunar soil. The work has been made at the V. I. Vernadsky Institute of Geochemistry and Analytical Chemistry of the USSR Academy of Sciences, with the aid of its Deputy Director Y. A. Shukaliukov. As has been well established, the isotopic ratios for every one of the five main components of the alloy (Ce, La, Nd, Fe, and Mg) do not differ from the terrestrial ones by more than 0.01%. In other words, the alloy was most probably produced from materials obtained within the Solar System.

2.3. Structure of the sample

Density of the sample (determined from its weight and volume) proved to be 5.974 g/cm^3. With allowance made for its composition and the densities of its main components (Ce — 6.79 g/cm^3; La — 6.18 g/cm^3; Nd — 6.98 g/cm^3), the resulting overall density of the sample should have been equal to 6.65 g/cm^3, that is 10.17% greater. This suggests that the alloy was not produced in a melting process. We assumed it could be a sort of cermet material having small pores inside it with an overall volume some 10% of the whole volume of the sample. This hypothesis has been corroborated more than once in the course of further investigations.

The structure of microsection metallographic specimens on the same side of the sample that had been examined with the *Microscan–9* and on another one, perpendicular to the former, was investigated using a metallographic microscope by G. A. Konstantinova. At magnifications from 100× to 800× one could see that some 10% of the sample's surface (4% of its volume) was occupied by cylindrical fibres (needle crystals) up to 12 x 1.2 micrometers in size. When the metal was etched in solutions of nitric, hydrochloric, and phosphoric acids in water with glycerine, the result was the same. The fibres were straight and light-colored. The other 96% of the sample's volume consists of an optically homogeneous (up to 1200× magnification) substance. It was impossible to see any discernible structure in the latter even at 7000× magnification, when using the *Microscan–9*, which indicates that the size of the particles and voids between them in this cermet material is less than 0.02 micrometers. The chemical composition of the sample presented in Table 1 is restricted only to this main phase of the sample's volume. There was found no preferential spatial orientation of the fibres inside the sample. Probably the object had not been processed by technological methods accompanied by plastic deformation of the material and therefore resulting in orienting the crystals in a preferred direction (such as the forging, stamping, rolling, drawing, or expanding used in Earth technology).

G. A. Konstantinova has also determined microhardness of the sample using the *PMT–3* measuring device. The test loads on a diamond pyramid were equal to 20, 50, and 100 grams; they lasted for 20 seconds. Under the 100 g load diagonals of the imprints measured from 127 to 145 micrometers on the larger surface of the sample, and from 146 to 153 micrometers on its end face. This more than guaranteed that the imprints would overlap the distance between the inclusions of the fibrous phase. There were made 22 and 13 imprints respectively, linearly arranged at intervals of 0.15 mm.

On the larger surface the sample's microhardness is equal to 115.1 (+3/-9) kg/mm^2, whereas on the smaller one 86.0 (+3.6/-9) kg/mm^2, which is close to the microhardness of unalloyed cerium (80 kg/mm^2). The low (less than 10%) dispersion of the measured values is truly remarkable. Usually, in polycrystalline alloys this dispersion reaches 50%, since the diamond pyramid strikes grains having different composition and/or orientation and therefore registers highly diverse microhardnesses. The same happens when the pyramid hits a boundary between the grains. Here, an imprint of the diamond pyramid covered from five to ten sections of the light-colored fibres of arbitrary orientation. In such a case, the low dispersion of the values may be possible only if microhardness and strength of the fibrous phase are close to those of the homogeneous one. If the fibres had been incorporated to enhance the strength of the material, they would have had greater strength and hardness, being, among other things, oriented along the vector of principal stresses.

Since this is not the case, we can suppose that the fibres (needle crystals) had not been added to the alloy for strengthening it. The aim was different, still unknown to us. At the same time, the microhardness of the alloy is 1.5–2 times greater than that of the rare earth alloys known from the literature. Besides, it varies by a factor of 1.34 times, depending on the direction. These facts point to some kind of orientation of the grains (despite their very small size — of the order of 0.01 micrometer), as well as to anomalous properties of the ultrafine particles of the sample's homogeneous phase.

Crystallographic examination of the sample was performed by recording X-ray spectra on a *DRON–2* laboratory-industrial installation. At the first stage of the investigation it was found out how the Syktyvkar geologists had obtained their strange result — the seemingly amorphous structure of the alloy. The point is that usually samples for the *DRON–2* are made in the shape of a stepped disk some 50 mm in diameter which is inserted into a steel circular holder. Since it was impossible to make such a big disk from the small sample that the geologists had got, a piece of a lesser size was fixed in the holder with the help of plasticine. But when amorphous plasticine is bombarded with strong X-rays, a blurred X-ray pattern appears, obscuring the diffraction patterns of the crystalline structure under investigation. This mistake proved to be of much use, though, since without it the sample would not have attracted any attention, remaining in obscurity.

There was, by the way, one more factor leading to misinterpretation of this X-ray diffraction pattern (revealed by L. A. Lyzina and A. F. Voronkov). Since rare earth alloys are, as a rule, soft and tough, polishing the surface of a sample creates a thin amorphous layer where the crystalline structure is crushed. This layer produces the X-ray pattern of an amorphous substance. To avoid this, rare earth samples must be etched before X-ray spectra are taken. Since the geologists did not know that they were dealing with a rare earth alloy, they omitted this important stage in their investigation.

Having etched a surface of the sample and examined it with the *DRON–2* device, we obtained 26 well-defined spectral lines (see Table 3), the first five of them being due to the steel holder (because of the small size of the sample) and therefore not included in the table. The same results have been independently obtained on another *DRON–2* instrument by N. V. Edneral, at the Department of X-ray Diffraction Analysis, Moscow Institute of Steel and Alloys.

Interpretation of the lines proved to be quite a problem. Only two lines from the 21 have been identified with the known interplanary distances for rare earths and their compounds: 2.97 A — this is one of the eleven lines typical for alpha-Ce, and 3.18 A — one of the 15 lines of beta-La. The other 19 lines measured with an accuracy of 0.01 A have not corresponded to any line known to exist for rare earths, their alloys and compounds, nor for magnesium nor iron. The data on interplanary distances in crystals of 302 cerium compounds and 516 compounds and alloys of lanthanum were examined, as well as more than three thousand compounds and alloys of neodymium, iron, and magnesium, having from 10 to 36 spectral lines.

Besides, on a *JEM 6A* electron microscope (manufactured in Japan) S. A. Us has determined interplanary distances of the crystals in the Vashka alloy from the electron diffraction patterns obtained when electrons having a wavelength of about 0.5 A traveled through thin (of the order of 10 atomic layers) parts of the crystals. With this aim in view filings were removed with a needle file from the sample placed into toluene (a medium which is chemically neutral for rare earths). Immediately after that the filings were placed into the electron microscope's vacuum chamber. Ten distinct circular electron diffraction patterns were obtained. All of them have had the same numbers of rings, the latter being equal in diameter. One photograph even demonstrates point reflections testifying that the electron beam traveled through an isolated microcrystal. These data suggest that all the particles are crystallographically identical.

Interplanary distances determined with the electron diffractometer are presented in Table 4.

These data are vastly different from those obtained on the *DRON–2* device both in the number of lines and their intensity, as well as in the values of interplanary distances.

When an electron microscope works as a diffractometer, the diffraction pattern arises as the electron beam (from 0.01 to 0.1 micrometer in diameter) passes through thin edges of the fillings removed from the sample with a needle file. The thickness of these edges must not exceed a dozen atomic layers. When thicker, the edge does not permit the passage of the electron beam; when thinner, the electrons do not interfere with the atoms of the crystal lattice. On the other hand, an X-ray diffraction pattern may be obtained only if the wavelength of the X-rays is less than the size of the crystalline particles comprising the substance. Since the ultradispersed phase of our sample is utterly fine, it interacted only with the electron beam. Table 4 represents the results

Table 3. Results of the X-ray diffraction analysis.

Interplanary distance d, in Angstroms	3.2474	3.1797	2.9767	2.8889	2.8063	2.6046	2.4752	2.2768	2.2181	1.9852	1.8463
Intensity of the lines (in % with respect to the most intense one)	100	40	10	10	80	10	10	10	40	80	40
Interplanary distance d, in Angstroms	1.7715	1.6939	1.6798	1.6091	1.5625	1.5377	1.4162	1.3925	1.2782	1.2550	
Intensity of the lines (in % with respect to the most intense one)	10	10	40	10	10	10	10	10	10	10	

Table 4. Results of the electron diffraction analysis.

Interplanary distance d, in Angstroms	4.38	4.20	3.78	3.03	2.52	2.39	2.26	2.10	1.89	1.78	1.64
Intensity of the lines (in % with respect to the most intense one)	20	100	80	20	50	10	40	30	10	10	10

of this interaction. On the contrary, the "fibres" (needle crystals) interacted only with the X-rays. The data presented in Table 3 are due to the structure of these fibrous crystals having the size of about one micrometer. The latter are just too big for electron diffractometry — just as the crystalline particles of the main phase of the sample are too small for X-ray diffraction analysis.

The fact that all the electron diffraction patterns show narrow rings of equal diameters (in one case even consisting of point reflections) also suggests the characteristic size of the ultrafine particles to be in the order of ten atomic layers, that is 10 Angstroms. Such a pattern may have been obtained only if the microcrystals were not deformed on the thin edges of the filings. This, in turn, was possible only if the microcrystals were separated from each other due to lesser strength of the *inter*crystalline bonds as compared with *intra*crystalline ones. Evidently the thin edges of the fillings constitute a lace of identical microcrystals having no plastic deformations and keeping their regular crystalline structure.

The interplanary distances presented in Table 4 were compared with 50,000 sets of such distances, characteristic of the known compounds and alloys of rare earths, magnesium, and iron. No correspondence has been found.

2.4. Magnetic properties of the sample

Regarding magnetic properties of the sample, it proved to be paramagnetic. When placed in an external magnetic field, such substances are magnetized in the direction of the external field, but when the latter is removed, they are immediately demagnetized. The external magnetic field gives rise to precession of electron orbits and vectors of magnetic moments of the atoms around the vector of the external magnetic field, aligning the former with the latter. In the absence of the external magnetic field the thermal motion of the atoms and molecules quickly disrupts this orientation and the internal magnetic field disappears.Vector **B** of the magnetic flux density in a paramagnetic substance may be found from:

$$\mathbf{B} = (1 + \chi_m)\ \mathbf{B}_{\text{ext}} \ ,$$

where $\mathbf{B}_{\text{ext}}$ is the magnetic flux density of the external field, and χ_m is the so-called magnetic (in our case paramagnetic) susceptibility of the substance.

For pure chemical elements χ_m ranges from 10^{-7} to $627{\cdot}10^{-6}$. In inorganic compounds, where valence electrons travel in orbits around groups consisting of several atoms of the crystalline lattice, the longer these orbits, the greater the paramagnetic susceptibility. Its maximum value reaches $92760{\cdot}10^{-6}$ (for hydrated dysprosium sulphate). Magnetic susceptibility of the majority of pure metals is low (in the order of 10^{-6} – 10^{-5}); only bismuth, uranium and plutonium are exceptions to this rule: their χ_m is equal to $284{\cdot}10^{-6}$, $414{\cdot}10^{-6}$, and $627{\cdot}10^{-6}$ respectively.

The Vashka sample proved to have an unusually great — and abnormally anisotropic — magnetic susceptibility: $26420{\cdot}10^{-6}$ in the direction along the greater axis of the parallelepiped, and $1768{\cdot}10^{-6}$ perpendicular to this axis.

The high value of χ_m indicates that the main phase of the substance consists of very fine particles, in which electrons travel without any resistance over their surfaces at the radius of about a few dozens of Angstroms from the center of a particle. (The same effect takes place in aromatic compounds where electrons move around the benzene ring, thereby considerably increasing their magnetic susceptibility.)

Since the electron diffraction patterns in our case are very distinct, these particles must have a sufficient number of atoms to form a perfect crystalline lattice not disrupted by the surface tension on the crystals or by compacting the cermet material, or by removing the fillings with a needle file. This may happen if the particles are identical, containing not more than a few thousand atoms (otherwise the electrons would not have passed through them). Each particle would then comprise only a few dozens of atoms of magnesium and iron. Atomic radii of cerium, lanthanum and neodymium are very close (about 1.8 A). When alloyed, they form, according to the Darnen–Gurry diagram, true solutions of magnesium (this element with atomic radius 1.6 A is soluble in cerium up to a concentration of 2.3%, whereas its concentration in the Vashka sample is 2.13%). As for iron, it cannot be dissolved in rare earths, having an atomic radius of 1.26 A and lying therefore outside the ellipse of solubility of the diagram. So, iron was probably added to the alloy to give rise to strains and tensions in the cubic lattice of the cluster (the particle of the ultradisperse phase). The small size of the clusters imparts to them properties of separate molecules where some electrons are collectivized and move around the particles meeting no resistance.

The high anisotropy of the sample's magnetic susceptibility ($26420{\cdot}10^{-6}$ versus $1786{\cdot}10^{-6}$) indicates that the axes of orbitals of the collectivized electrons in the clusters point in the same direction. These axes must have obtained their one-sided orientation when the object was being manufactured. This was possible only if the cermet was compacted in a very strong magnetic field that had turned the clusters in one direction before the particles had agglomerated and kept them from turning while the substance was being compacted and sintered. The lack of any preferred orientation in the fibrous phase of the material testifies that the preferred orientation of the main phase was not achieved via plastic flow, that is by its being subjected to mechanical deformation. These "fibres" (needle crystals) do not participate in forming the anisotropy, having no abnormal magnetic susceptibility.

2.5. Relevant technologies

It was not until the late 1980's that the manufacture of cermet artifacts from ultradispersed powders was invented, developed and introduced into practice. Objects compacted from globular metallic microparticles consisting of a few hundreds of atoms only proved to have an increase of several times in strength, hardness and impact elasticity. This is due to the very great surface energy (surface tension), as well as to a very large overall area of these particles. Such particles are condensed from separate atoms in a plasma jet or grown in chemical solutions. In the air an ultradispersed powder is oxidized explosively. In 1976, when the Vashka object was discovered (having being evidently manufactured earlier), cluster technologies were still unknown.

2.6. The age of the find

The age of the Vashka find was estimated at laboratories headed by Dr. V. Miller and Dr. O. Gorbatiuk, at the All-Union Institute of Nuclear Geophysics and Geochemistry (Moscow). There was analyzed the energy of alpha-, beta, and gamma-radiation emitted by products of decay of the uranium and thorium series, as well as their isotopes. The isotopic ratio between ^{238}U and ^{235}U proved to be the normal terrestrial one, but the decay products of this series are practically absent — even though the uranium content in the sample is as high as 0.04%. The average uranium content in rocks is about 0.0003% only. Hence, uranium could not be an ore impurity; it was deliberately added to the alloy, its decay products having been removed. In any event, the lack of the decay products of the uranium series means that the age of the sample is less that 1000 years. And the lack of decay products of the thorium series makes this estimation much more precise: 30 years, or less.

2.7. Hypothetical reconstruction of the initial object, its function, and the technology of fabrication

Examining with an industrial microscope the macrostructural lines on a side of the sample that was not sawed (that is, it was a fracture surface of the initial Vashka find), it was discovered that the radius of curvature of these lines was equal to 60 cm. Since this radius proved to be the same for three parallel macrostructural fracture creases, one can suppose that the wrinkles are a part of the macrostructure of the initial object, and did not arise when the object exploded or split. Therefore, the initial object, a fragment of which was found at the Vashka river, had been shaped like a ring, cylinder, or ball about 120 cm in diameter, with a wall thickness of some 10 cm.

At the All-Union Institute of Nuclear Geophysics and Geochemistry it was also established that the iron present in the sample has not formed any oxides. From this fact it follows that the initial object had been made from oxygen-free components, being manufactured in high vacuum.

Analyzing publications on known existing fields of application of rare earths, we could find the only possible use for the device whose fragment has been studied. Its unique anisotropic magnetic susceptibility, as well as its round shape and thick walls would be necessary only if it was the shell of a cryogenic cooling installation.

Great magnetic susceptibility is used in such installations for so-called "magnetic cooling" to within one degree of absolute zero. The shell is first cooled by liquid helium and then it is subjected to a strong magnetic field. The field orients the orbitals of the electrons in the shell causing its heating (in accord with the law of conservation of energy) by about one degree. This heat is carried away evaporating the liquid helium, after which the magnetic field is switched off. Thermal motion returns the orbitals to their chaotic state, which results (again in accord with the law of conservation of energy) in a temperature fall. In this way a final temperature of some 0.001–0.0001 K may be achieved. The greater the magnetic susceptibility of the material and the flux density of the magnetic field, the more efficient is the process. Of course, it would be much more preferable to use for such an installation a metallic sphere, not a sphere made of dysprosium sulphate (even though the magnetic susceptibility of the latter is in 3.5 times greater).

Anomalous properties of the sample suggested an idea that it could also possess the property of high-temperature superconductivity. Although before 1986 there was no experimental proof of such a phenomenon, theoretically it could not be ruled out. Dr. N. E. Alekseyevsky, the head of the Laboratory of Superconductivity (Institute for Physical Problems of the USSR Academy of Sciences, Moscow) whom I contacted in this connection was very skeptical concerning any effects of superconductivity at temperatures above 32 K. However, he agreed to perform a simple test to verify this idea. It is known that a superconductor is pushed out from magnetic field. But when the sample was brought near a powerful electromagnet, it was attracted by the latter. It was therefore concluded that the Vashka find had no superconducting properties. Only a few years later it became evident that for high-temperature superconductors this test does not work.

The findings of this investigation allow the following reconstruction of the technology used to fabricate the device. Ultrafine particles of the composition presented in Table 1 were made in such a way that they formed quasi-molecules in which valence electrons travel near their surfaces meeting no resistance (just as happens in the benzene ring). To these particles were added (with an unclear but probably justified aim in view) needle crystals ("fibres") whose length reaches ten micrometers. Then the ultrafine particles alone were oriented in a strong external magnetic field, shaped as a thick-walled vessel and compacted in the presence of the field.

3. On the origin of the Vashka object

When cermet is compacted and sintered using existing cluster technologies, the heat release is so great that the temperature of the compacted material rises by 1000°. If this had happened to the powder from which the Vashka find was compacted, it would have been melted down (the melting points of Ce, La, and Nd are 795°C, 920°C, and 1024°C respectively; for the alloy it would have been even lower). In this case, there would have originated throughout the whole volume of the sample big crystals, which are evidently absent. Therefore, no heating up to the melting point occurred and the process of compaction was accompanied by very effective heat removal. In fact, partial recrystallization occurs even when normal cermets are sintered at temperatures some 100–150° lower than the melting point (to accelerate the process). To avoid melting and subsequent loss of the structural and magnetic properties of the clusters, the powder must have been compacted at a very low temperature with a very gradual increase of pressure. Actually, the temperature of the substance must have not exceeded the Curie point, that is about half as high as the melting point — otherwise the particles could not have been oriented with the magnetic field.

However, cold compaction of powders up to acceptable densities requires pressure in the order of 10–20 thousand atmospheres. Using existing cluster technologies it is impossible to achieve levels of porosity less than 17%, while maintaining at the same time the necessary strength characteristics. Neither is gradual compaction of a sphere possible, as big as 1.2 meters across with 10 cm wall thickness, while maintaining a magnetic field inside the substance. Such a sphere must have weighed 2.3 tons. To create the required pressure, there would have been needed a chamber with very thick steel walls which no magnetic field could penetrate. To put it briefly, it would be utterly impossible to manufacture this device with the help of existing terrestrial technologies. Thus, it was probably manufactured with the help of an alien technology.

THE PROBLEM OF THE TUNGUSKA METEORITE

SOME ANOMALIES OF THE DISTRIBUTION OF RARE EARTH ELEMENTS AT THE 1908 TUNGUSKA EXPLOSION SITE

S. V. Dozmorov

Results of examination of samples from pit No. 1, located 500 meters east of the Ostraya mountain, are as follows:

1. Judging from the even distribution of holmium and erbium throughout the layers of the pit (Table 3, page 12), as well as their much lower content in the samples as compared with their average content in the Earth's crust, these elements at the site are of purely terrestrial origin — that is, the Tunguska Space Body (TSB) did not contain them.

2. Based upon the concentrations of holmium and erbium, one can extrapolate the "terrestrial" component of the concentrations of other lanthanides in this area. (This extrapolation is naturally tentative; it would have been better to take a sample of soil from the same region, but further to the south along the TSB trajectory, outside the forest leveling zone.) Starting from these data as the base, it is possible to roughly estimate the excess of the actual average concentrations of the lanthanides in the pit over the extrapolated values (see Table 1, page 11).

3. The nearly even distributions of gadolinium and lutecium (Table 3) indicate that these elements are most likely of terrestrial origin too. A slight excess of the gadolinium concentration over the extrapolated level (by five times) cannot be regarded as fully reliable. It may well be due to extrapolation error.

4. Layer-by-layer variations in the concentrations of praseodymium and neodymium (shown in Table 4, page 13) are very distinct, coinciding with variations of the other lanthanides, namely lanthanum, cerium, ytterbium, dysprosium, thulium, samarium, and europium. This suggests that praseodymium and neodymium may have been contained in the TSB as impurities in its substance.

5. There are several sets of layers (shown in Tables 2–4) where the content of some chemical elements, mainly rare earths, is in excess of the average level. These are:

Layers 4–6: lanthanum, cerium, samarium, europium, terbium, dysprosium, thulium, ytterbium, as well as iron and zirconium with hafnium.

Table 1

Element	Extrapolated "terrestrial" component of the concentration, %	Estimated excess
Lanthanum (La)	$0.2 \cdot 10^{-3}$	2
Cerium (Ce)	$0.4 \cdot 10^{-3}$	3
Samarium (Sm)	$0.5 \cdot 10^{-4}$	15
Europium (Eu)	$0.1 \cdot 10^{-4}$	150
Gadolinium (Gd)	$0.1 \cdot 10^{-3}$	5
Terbium (Tb)	$0.1 \cdot 10^{-4}$	55
Dysprosium (Dy)	$0.4 \cdot 10^{-4}$	5
Thulium (Tu)	$0.6 \cdot 10^{-5}$	130
Ytterbium (Yb)	$0.2 \cdot 10^{-4}$	800
The actual praseodymium, neodymium, and lutecium concentration is 10–100 times lower as compared with the extrapolated level.		

Layers 8–13: lanthanum, cerium, samarium, terbium, dysprosium, thulium, ytterbium, iron, zirconium with hafnium, copper (the latter having a very high value in layer No. 13).

Layers 17–21: europium, terbium, dysprosium, thulium, ytterbium, zirconium and hafnium.

Layer 25: copper, iron.

Layers 28–30: europium, ytterbium, iron, zirconium and hafnium.

Layers 31–32: thulium, iron, zirconium and hafnium.

All the above-listed lanthanides can be grouped by the character of their layer-by-layer distribution as follows: 1) lanthanum, cerium, samarium; 2) europium; 3) terbium, dysprosium, thulium, ytterbium. Judging from the total combination of variations in concentrations of these rare earths it is the layers 4–6 that must be assigned to the period of the Tunguska catastrophe. The well-defined maxima of the concentrations in layers 8–13 may be due, on the one hand, to transfer of the elements by ground water and on the other hand, to the "shooting" of the "catastrophic" layers at the moment of the TSB explosion. Maxima observed in lower strata were most likely caused by transfer of ions of the elements by ground water.

6. There is observed a distinct abnormally high concentration of such rare earth elements as samarium, europium, thulium, terbium, and ytterbium, which is not typical of natural objects, being those of terrestrial or cosmic origin.

7. Together with the known data on the above-average barium content in the area of the Tunguska explosion, the results obtained may favor most unusual composition for the TSB, namely the presence in the TSB of some systems that contained a superconducting high-temperature ceramic made on the basis of the following combination of elements: barium — a lanthanide — copper. Such ceramic keeps superconductivity up to the temperature of liquid nitrogen (–196°C and can be used for constructing very effective energy and information storage devices. Obviously, such a substance cannot be natural.

Table 2. Content of iron, copper and the sum of zirconium with hafnium in pit No. 1.

Layer	Content, in mass %.		
	$Fe, 10^{-2}$	$Cu, 10^{-5}$	$Zr+Hf, 10^{-3}$
1	2.6	2.8	8.0
2	2.6	2.0	**13.7**
3	2.6	2.9	**21.0**
4	**3.4**	3.5	**17.9**
5	**4.1**	4.4	1.9
6	**3.7**	4.8	**40.2**
7	2.9	6.0	4.7
8	2.6	5.0	8.5
9	**4.1**	7.2	4.2
10	2.5	3.2	**15.1**
11	**7.0**	7.2	8.5
12	1.8	4.4	**12.3**
13	**4.7**	**117.0**	5.9
14	**5.8**	5.0	**12.3**
15	2.7	4.4	7.1
16	2.1	5.8	9.6
17	2.5	7.3	7.3
18	**6.1**	7.3	10.9
19	2.4	5.7	**23.2**
20	2.4	6.3	**17.2**
21	2.4	7.1	10.9
22	**4.2**	6.5	2.6
23	**7.4**	9.6	1.9
24	3.6	4.1	5.9
25	**6.3**	**16.0**	3.3
26	**6.3**	1.2	**20.3**
27	**6.2**	2.0	8.4
28	**5.9**	3.2	6.8
29	3.2	3.4	5.4
30	1.8	3.6	10.7
31	2.6	3.4	**24.4**
32	**4.6**	3.4	6.8
33	2.6	2.2	8.0
Average	$3.9 \cdot 10^{-2}$	$8.5 \cdot 10^{-5}$	$11.0 \cdot 10^{-3}$
Content in the Earth's crust, mass %	5.1	$1.0 \cdot 10^{-2}$	$20.3 \cdot 10^{-3}$

Table 3. Content of the elements of the yttrium subgroup (gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutecium) in pit No. 1.

Layer	Content, in mass %.							
	Gd, 10^{-3}	Tb, 10^{-4}	Dy, 10^{-4}	Ho, 10^{-5}	Er, 10^{-4}	Tu, 10^{-4}	Yb, 10^{-3}	Lu, 10^{-6}
1	0.6	2.1	0.9	0.2	0.2	4.0	6.3	0.4
2	0.5	0.6	**2.4**	0.1	0.4	5.6	6.6	0.4
3	0.5	4.8	1.9	0.2	0.4	6.5	14.0	0.8
4	0.3	**8.7**	**3.5**	0.2	0.3	**13.8**	**25.6**	0.6
5	0.3	**26.8**	**10.4**	0.3	0.4	**8.2**	**72.6**	0.4
6	0.6	2.0	0.8	0.2	0.2	**10.3**	5.9	0.4
7	0.6	0.8	0.3	0.1	0.1	**10.1**	2.3	0.4
8	0.3	**9.2**	**3.7**	0.3	0.3	**12.5**	**26.8**	0.7
9	0.3	**8.5**	**3.4**	0.2	0.3	**13.6**	**24.7**	0.7
10	0.2	**10.6**	**4.3**	0.3	0.3	**15.1**	**31.1**	0.7
11	0.4	**6.9**	**2.8**	0.2	0.2	6.1	**20.1**	0.7
12	0.6	2.0	0.8	0.2	0.2	3.2	5.9	0.6
13	0.3	**8.1**	**3.2**	0.1	0.3	7.8	**23.4**	0.4
14	0.4	4.9	2.0	0.2	0.2	6.3	14.3	0.4
15	0.4	**6.0**	**2.4**	0.2	0.2	**9.1**	**17.7**	0.4
16	0.5	3.9	1.6	0.2	0.2	**8.4**	11.4	0.4
17	0.5	5.0	2.0	0.2	0.2	**10.1**	14.7	0.4
18	0.6	2.5	1.0	0.2	0.2	3.7	7.0	0.7
19	0.7	1.6	0.6	0.1	0.1	2.8	4.9	0.7
20	0.7	3.5	1.4	0.1	0.1	2.2	4.3	0.7
21	0.4	**7.6**	**3.0**	0.2	0.3	**8.4**	**22.0**	0.4
22	0.3	5.6	**3.0**	0.2	0.2	7.1	16.1	0.4
23	0.4	**7.6**	**3.0**	0.2	0.3	**10.1**	**21.9**	0.4
24	0.5	4.6	1.8	0.2	0.2	6.8	13.5	0.8
25	0.5	4.6	1.8	0.2	0.2	5.0	13.5	0.7
26	0.5	4.7	1.8	0.2	0.2	5.7	13.6	0.8
27	0.5	**7.0**	**2.8**	0.2	0.3	7.5	**20.3**	0.4
28	0.6	2.3	0.9	0.2	0.2	5.0	6.9	0.5
29	0.7	0.6	0.3	0.1	0.1	4.5	1.8	0.6
30	0.6	0.7	0.3	0.1	0.1	7.0	**25.4**	0.7
31	0.5	5.2	2.1	0.2	0.2	**12.5**	15.6	0.8
32	0.5	5.0	2.0	0.2	0.2	**9.5**	14.8	0.7
33	0.5	3.8	1.5	0.2	0.2	7.5	11.3	0.7
Average	$0.5 \cdot 10^{-3}$	$5.4 \cdot 10^{-4}$	$2.2 \cdot 10^{-4}$	$0.2 \cdot 10^{-5}$	$0.2 \cdot 10^{-4}$	$7.8 \cdot 10^{-4}$	$16.3 \cdot 10^{-3}$	$0.6 \cdot 10^{-6}$
Content in the Earth's crust	$1.0 \cdot 10^{-3}$	$1.5 \cdot 10^{-4}$	$4.5 \cdot 10^{-4}$	$1.3 \cdot 10^{-4}$	$4.0 \cdot 10^{-4}$	$8.0 \cdot 10^{-5}$	$3.0 \cdot 10^{-4}$	$1.0 \cdot 10^{-4}$

8. To verify these results, it would be necessary: first, to analyze the soil from a region outside the forest leveling area, preferably further to the south from it along the TSB trajectory; second, to analyze the soil layers from the pit No. 2, located 500 meters west of the Ostraya mountain, as well as from additional pits that would be bored in 1–2 meters from the pits Nos. 1 and 2.

References

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Table 4. Content of the elements of the cerium subgroup (lanthanum, cerium, praseodymium, neodymium, samarium, europium) in pit No. 1.

Layer	Content, in mass %.					
	La, 10^{-3}	Ce, 10^{-3}	Pr, 10^{-6}	Nd, 10^{-5}	Sm, 10^{-3}	Eu, 10^{-3}
1	0.2	0.6	0.3	0.2	0.5	**1.7**
2	0.1	0.3	0.1	0.4	0.5	**1.7**
3	0.4	1.1	0.6	3.4	0.6	1.5
4	**0.7**	**1.7**	**1.1**	**8.3**	**0.8**	0.9
5	**2.0**	**4.8**	**3.7**	4.0	**1.4**	1.0
6	0.3	0.6	0.3	1.7	**1.6**	**2.1**
7	0.1	0.3	0.1	**6.3**	0.5	**2.0**
8	**0.7**	**1.5**	**1.2**	**7.1**	0.5	1.0
9	**0.8**	**1.7**	**1.2**	6.8	0.5	1.4
10	**0.8**	**2.2**	**1.2**	**5.0**	**0.8**	0.7
11	**0.6**	**1.4**	**1.2**	**4.8**	0.4	1.3
12	0.2	**1.6**	**1.3**	1.4	0.3	**1.7**
13	**0.7**	**1.6**	**1.1**	3.4	0.3	1.3
14	0.4	1.1	0.6	3.7	0.4	1.3
15	0.5	**1.3**	0.6	**6.0**	0.5	1.3
16	0.5	**1.2**	0.5	**5.0**	**6.8**	1.5
17	0.5	1.1	0.6	**4.6**	0.5	**1.8**
18	0.2	0.6	0.4	1.3	0.5	**1.6**
19	0.1	0.5	0.4	1.2	0.4	**1.9**
20	0.1	0.2	0.4	1.0	0.3	**2.0**
21	0.4	1.0	**1.0**	**5.4**	0.3	**1.6**
22	0.4	1.2	0.7	**5.3**	0.4	1.3
23	0.4	**1.5**	**1.0**	**6.0**	0.2	1.3
24	0.4	1.0	0.6	3.7	0.2	**1.7**
25	0.4	1.0	0.6	3.7	0.4	1.5
26	0.4	1.0	0.6	4.0	0.6	1.4
27	0.2	1.1	**1.0**	**5.1**	0.7	1.0
28	0.2	0.6	0.3	2.6	0.5	**1.7**
29	0.3	0.3	0.7	0.9	0.2	**2.1**
30	0.3	0.3	0.7	**4.9**	0.2	**2.0**
31	0.4	1.1	0.7	**8.3**	0.6	1.4
32	0.4	1.0	0.7	**6.8**	0.4	1.4
33	0.3	0.8	0.5	**5.7**	0.4	1.4
Average	$0.4 \cdot 10^{-3}$	$1.1 \cdot 10^{-3}$	$0.8 \cdot 10^{-6}$	$4.2 \cdot 10^{-5}$	$0.7 \cdot 10^{-3}$	$1.5 \cdot 10^{-3}$
Content in the Earth's crust	$1.8 \cdot 10^{-3}$	$4.5 \cdot 10^{-3}$	$7.0 \cdot 10^{-4}$	$2.5 \cdot 10^{-3}$	$7.0 \cdot 10^{-4}$	$1.2 \cdot 10^{-4}$

A SCIENTIFIC JOURNAL ON PALEO-SETI*

Y. N. Morozov

Existence of a professional scientific journal is both a natural condition of normal functioning of the corresponding field of research and a confirmation of its scientific nature. It is not surprising then, that trying to bring up studies of the paleovisit problem to a true scientific level, researchers do usually start by publishing a specialized periodical. This is not an easy task, though. For example, the attempt to launch the *International Journal of Paleovisitology* undertaken in the late 80's/early 90's by a group of scientists, scholars and engineers interested in the problem has failed. Now another experiment of this sort is in progress.

We mean the journal *Scientific Ancient Skies* (hereafter referred to as *SAS*) that has been published starting in 1994. Its subtitle defines the periodical as a "journal on Paleo/Archeo-SETI". The name of the journal, rather unusual for a scientific publication, arose from the fact that it is a "relative" of the bulletin *Ancient Skies* that has been published during the last 25 years by the Ancient Astronaut Society. In that bulletin the problem of paleovisits was discussed on a popular ("pre-scientific") level. The term "paleo-SETI" (coined in 1989 by the Russian scientist Dr. Vladimir Avinsky) may be regarded as synonymous with the term "paleovisitology". Introducing the additional concept of "archeo-SETI" must have led to a more definite division between historical and prehistorical events. It is, however, of little practical worth. Discussing possible extraterrestrial traces in mythologies of North American Indians, history of Sumer, or in the Mayan culture, *SAS* authors prefer to use the term "paleo-SETI" in all cases. It is evident that this field of investigations is not sufficiently differentiated in itself and therefore it is hardly reasonable to separate its "paleo-" aspects from its "archeo-" ones.

In the Editorial for the first issue of *SAS*, its Chief Editor, Dr. Johannes Fiebag, has formulated the working hypothesis of paleo-SETI as follows: "In historical, early- and pre-historical, as well as in geological times, both the Earth and other — still unexplored — regions of the Solar System were visited and/or contacted and/or influenced (directly or indirectly) by intelligent extraterrestrial beings... or by their "representatives" (e.g. cybernetic probes) coming here from beyond the Earth or even from beyond the boundaries of the Solar System" (p. 1). This hypothesis should be proved or rejected. *Scientific Ancient Skies* offers its pages for discussing all the pros and cons.

The *SAS* Editor from the very beginning warned his readers that the journal may be published with certain irregularities. Its first issue appeared in 1994, and the second a year later. The third issue of *SAS* issue was supposed to be printed and distributed in 1997, but as this review is being prepared it did not appear as yet. If this does happen (which we sincerely hope for), its title will probably be changed — just because the bulletin *Ancient Skies* has already ceased publication. Thus, the two *SAS* issues published by this time may be considered as a completed stage of the journal's life worthy of appreciation and review.

In general, one can notice that the works published in *SAS* demonstrate difficulties and obstacles confronting researchers in this field rather than their achievements.

As noted with good reason in a paper by A. Kandler (issue 2), no serious research procedures have ever been theoretically developed in paleo-SETI. Unfortunately, the proposals of this author can hardly contribute to significant progress in this direction. As a rule, he either repeats commonly known scientific principles, or refers to "intuitive" criteria that have been in use for a long time among students of the paleovisit problem — never leading them to any "hard" results. And trying to suggest new ideas of this kind, A. Kandler runs the risk of disorienting researchers even more... For instance, he believes that the "empirical work" in paleo-SETI must be based on "scholarly methods of sociology" — such as "interview", including "interrogation under hypnosis", etc. Interestingly enough: *who* must be "interrogated under hypnosis" when archaeological monuments, rock paintings, medieval frescoes, or ancient manuscripts are studied? Apparently, A. Kandler somewhat vaguely understands the difference between paleo-SETI and ufology, where hypnosis is in use indeed in work with UFO witnesses and victims of "abductions".

Much more correct comprehension of specific features of the object of study has been shown by P. Fiebag in his paper "Possibility to employ mythology and cultural memory for paleo-SETI studies..." (issue 2). The author analyzes myths of the North American Indian tribe of Hopi about their heavenly teachers, the "kachinas". Using numerous theoretical works, P. Fiebag demonstrates that the content of the myths is repeatedly duplicated in various cultural codes. Apart from narrative texts that are transmitted from generation to generation, it is fixed in the "memory of

* *Scientific Ancient Skies*, 1994, issue 1; 1995, issue 2. Published by the Ancient Astronaut Society, CH–3803 Beatenberg, Switzerland.

objects" (rock paintings, dolls, masks, sacred objects on a terrain, etc.), as well as in "mimetic memory" (rituals), etc. As a result, the information, set in the myths, may be kept intact for many centuries.

This side of mythology has been revealed by P. Fiebag very convincingly. But can the problem implied in the title of his paper be completely reduced to it? The author is hardly correct in stating that "established science permanently reproaches paleo-SETI with its regarding myths as historical archives and forgetting that their contents were always transmitted only by oral tradition" (p. 8). What in fact makes historians doubt if myths can be used as sources of trustworthy information on the past, is the very specific character of mythology as a cognitive system, not just the oral form of transmitting mythological stories through ages. To which extent mythological motifs could be *initially* adequate to the real events — this is a question to which paleo-SETI cannot give a definite answer.

Another Achilles' heel of contemporary paleo-SETI — a one-sided look at historical sources — has shown itself in an interesting paper by L. Gentes (issue 2). An ancient Indian epic contains descriptions of an aerial attack on the city of Dvaraka (*Mahabharata*, book 3; *Bhagavata Purana*, book 10). The author compares these with descriptions of air raids by bomber aircraft of today, believing that they resemble each other considerably. It would be, however, very essential to compare simultaneously these epic scenes with those concepts that creators of the *Mahabharata* and *Bhagavata Purana* could invent, having no knowledge of advanced military machinery — for instance, being impressed by terrible natural disasters. Only considering the text from *both* these sides would make it possible to determine which of these two interpretations of the ancient Indian epic — new or traditional — is closer to the truth. The author, however, has confined himself to looking at this text from the viewpoint of 20th century technologies, thus significantly depreciating his conclusions.

Let us consider this thesis in some detail. The *Bhagavata Purana* informs us that an airship (vimana) rained on the city destructive weapons, namely enormous stones, trees, thunder arrows, snakes, and gravel. L. Gentes believes this list to be just metaphoric "designations of some bombs that exploded when reaching their targets, causing fires and hurricanes and raising clouds of dust" (p. 34). Terrible whirlwinds and dust blanketing the sky are in fact mentioned in the epic. But there is no reference to blast effects (a flash plus a sound), neither — what really matters — a word about fires. Meanwhile, the testimonies of witnesses of the bombing of Hamburg at the time of World War II used by L. Gentes to demonstrate the close resemblance between the epic weapons and the fighting equipment of today tell of gigantic fires, fiery whirlwinds, rains of sparks, and thousands of people who burned alive or perished from the terrible heat. The creators of the ancient Indian epic, making up their pictures of the aerial bombing of the city, have completely dispensed with the fiery component. Obviously, the real basis for their fantasies were natural phenomena — hurricanes and falls of stones — and not ones of technical origin.

How risky is it to depend in paleo-SETI studies upon superficial analogies with technology of today, has been convincingly demonstrated in a paper by M. Haase, worthy to be distinguished from other materials published in the first issue of *SAS*. Some time ago on the ceiling of an ancient Egyptian temple in Abydos were discovered pictures resembling outlines of a "helicopter", "tank", and "submarine" of fairly modern design. M. Haase reveals their real origin. The title of Pharaoh Ramses II was written down over a partly painted hieroglyphic inscription with the title of his father, Pharaoh Seti I. In time, the initial text showed through the subsequent one. The superposition of the hieroglyphs has created queer figures, some of them having a false resemblance to outlines of modern technical objects.

Generally speaking, any interpretations of ancient texts and pictures are rather subjective, that is why of special significance for paleo-SETI are cases where the possible association of an ancient object with hypothetical paleovisits can be verified — even if in part — by exact methods of natural sciences. An expedition of the Ancient Astronaut Society brought from Peru two samples intended for mineralogical analysis. One of them is a piece of rock originating from the mountains above the ancient city of Sacsayhuaman. (It was supposed that the surface of these rocks has been vitrified under the influence of high temperatures — possibly resulting from a technogenic catastrophe.) A second sample is a fragment of a clay figurine from the so-called "second collection" of Dr. J. Cabrera that contains sculptures resembling pictures on the controversial "Ica stones" (the "first collection" of Dr. Cabrera). Those well-known pictures, supposedly of ancient origin, display scenes from the life of a highly advanced civilization: heart operations, sky observations through telescopes, etc. Both these samples have been studied by Dr. E. Freyburg, a geologist. His report has been published in the second issue of *SAS*. The expert concludes that: 1) there are no traces of vitrification on the rock; 2) the age of the clay figurine cannot be accurately determined, but it is not very old. Thus, the results of this analysis do not favor the "sensational" interpretations of these objects. Nevertheless they are helpful, increasing our knowledge about objects that are of interest for paleovisitology.

Of course, even negative results obtained in the course of paleovisitological investigations, at the current state of paleo-SETI must make us rejoice rather than disappoint. Any unbiased observer would agree that the number of the "supposed extraterrestrial traces" discussed in paleovisitological literature is too large for all of them to have a bearing on real ET visits to the Earth. The negative attitude of established science to the Ancient Astronaut theory is associated not only with the evident contradictions between the latter and the dominant paradigms of science; much is due to the abundance of speculative interpretations of facts, so typical of adherents of this theory. However, when such interpretations are criticized by scientists not interested in looking for ET traces, nor in developing paleo-SETI, the results are far from productive: the paleovisit problem is usually rejected as a whole, being considered as absurd and unscientific. Therefore, revealing false "paleovisit traces" must become one of the most important tasks of paleo-SETI. In fact, to obtain the status of a *scientific* field of investigations, paleo-SETI badly needs to develop an ability to look critically at its own conceptions. Only then might "big science" eventually recognize this field of research.

It should be noted that the "level of criticism" of these *SAS* issues is fairly high. Apart from the above-mentioned papers by M. Haase and E. Freyburg, the reader's attention will certainly be attracted by a paper by W. Siebenhaar (issue 2) which sharply but justly criticizes the concepts of Z. Sitchin, the well-known author of *The Twelfth Planet* and other books of *The Earth Chronicles* series. Two more ideas that have been popular for a long time are invalidated in other materials published in *SAS*: the opinion, according to which the Egyptian pyramids could have been built only with the help of extraterrestrial technologies (issue 2, pp. 46–57, 66) and the assumption that the nuclear weapon was in use in Ancient India (issue 2, pp. 31, 36). If it is remembered that the author of a paper published in *SAS* argues with its Chief Editor (issue 2, p. 22), it becomes evident that the spirit of free discussion lacking in some respectable scientific periodicals is still alive on the pages of *SAS*.

Will the journal become a connecting link between paleo-SETI and "big science"? This seems to depend on many a factor, some of them being out of control of the *SAS* editorial board. However, certain successes may be achieved due to a considered editorial policy. Under prevailing conditions it is hard to hope for an early "breaching" of the barrier separating paleo-SETI from established science, but "leaking" of professional interests of *some* scientists through this barrier can (and must) be promoted. This would be favored, in particular, by publishing in *SAS* information, analytical estimates and viewpoints that would be of value to science even irrespective of the controversial "Ancient Astronaut theory".

The results of the mineralogical examination made by E. Freyburg should be certainly placed into this category. By the way, they also argue against the prevailing assumption that the rocks near Sacsayhuaman were polished by a glacier (issue 2, p. 40). In another paper, E. Freyburg analyzes positive and negative sides of the well-known hypothesis put forward by J. Davidovits, according to which the stone blocks for the Gizeh pyramids were cast from a "geopolymer concrete". The reasoning of geologist E. Freyburg may be of interest to Egyptologists — just as the calculations performed by mathematician M. Haase with regard to the amount of work and the duration of the process of building the Great Pyramid of Cheops. Thus, there exist in the *SAS* issues published by this time some "baits" for specialists from the academic world; but these are still few and far between.

Here one could have stopped, but a concluding remark seems to be necessary... Despite its English title, *Scientific Ancient Skies* is being published only in German. This appears to be a natural result of the process that may be called "Germanization" of information streams in the field of paleo-SETI. Let us compare the following figures: in the 60's books on the problem of paleovisits published in the German-speaking countries represented 13% of the whole number of those published all over the world, in the 70's this figure rose to 33%, in the 80's up to 64%, and in the 90's it has reached (according to incomplete data) 75%. At present students of the paleovisit problem in Germany, Austria and Switzerland are much better organized and active than their colleagues from other parts of the world. The German language has rightfully assumed its place as *the* leading working language of paleo-SETI.

The reverse side of the medal is that a high proportion of the most serious works on the paleovisit subject matter remains closed for those (rather numerous) researchers who have no good command of German, to say nothing about the world scientific community, for which the main international language has long been English. Therefore, the editorial board of the journal should probably think on how to overcome this language barrier. The simplest (although hardly sufficient) solution would be to supplement the papers published in *SAS* with short abstracts in the English language.

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