

COMPOSITION ANALYSIS OF THE BRAZIL MAGNESIUM

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ABSTRACT

Some of the surviving fragments of the Brazil magnesium, that purportedly had their origin in the explosion of a UFO, have been subjected to surface, internal and isotopic analyses.

The surface composition of four of the specimens has been determined to better than 1 ppm (part per million). There are some similarities, but also significant differences, so it is clear that the specimens were subjected to different influences. Some of the impurities (such as sodium and calcium) may be due to sea water or sand, but many of the impurities are incompatible with such contamination. Some of the impurities (titanium, chromium, iron, cobalt, selenium, strontium, yttrium, niobium, palladium and barium) may point towards an origin in a technological device or devices.

Two specimens of Brazil magnesium, together with four comparison specimens, have been subjected to internal analysis by a laser ablation ICP-MS instrument (inductively coupled plasma mass spectrograph). This analysis shows that the Brazil specimens contain calcium at a few thousand ppm, and (as found by the Colorado Project) both strontium and barium at a few hundred ppm. One specimen also contains titanium at a few hundred ppm. This analysis indicates that the existing Brazil samples are not as pure as magnesium specimens readily available in the 1950s.

Some of the specimens have been subjected to isotopic analysis. The only departures from normal isotopic ratios are small differences that may be attributed to fractionation as a result of heat treatment.

The origin of these fragments remains a mystery. There is no evidence that the specimens are of extraterrestrial origin.

1. INTRODUCTION

The material that is here referred to as the "Brazil magnesium" has an important place in UFO research. It was the only material specimen investigated by the Colorado Project, which is the only unclassified UFO research project funded by a United States government agency (Condon & Gillmor 1969). (Footnote 1)

The Brazil magnesium was first mentioned in a short article published in the Rio de Janeiro newspaper El Globo on September 14, 1957, reproduced in its original Portuguese in Appendix 1. This article, headed "UM FRAGMENTO DE DISCO-VOADOR!" [A Fragment from a Flying Disk!] was written by the El Globo society columnist, Mr. Ibrahim Sued, who reported that he had just received an interesting letter which he reproduced in his column (Sued 1957). Professor Pierre Kaufmann of the Instituto Presbiteriano Mackenzie, Sao Paulo, Brazil, has kindly reviewed this column, and supplied the following translation:

Dear Mr. Ibrahim Sued. As a faithful reader of your column, and an admirer of yours, I wish to give you, as a newspaperman, a "scoop" concerning flying discs. If you believe that they are real, of course. I didn't believe anything said or published about them. But just a few days ago I was forced to change my mind. I was fishing together with various friends, at a place close to the town of Ubatuba, Sao Paulo, when I sighted a flying disc! It approached the beach at unbelievable speed and an accident, i.e. a crash into the sea, seemed imminent. At the last moment, however, when it seemed it was almost striking the waters, it made a sharp turn upward and climbed rapidly on a fantastic impulse. Astonished, we followed the spectacle with our eyes, when we saw the disc explode in flames. It disintegrated into thousands of fiery fragments, which fell sparkling with magnificent brightness. They looked like fireworks, despite the time of the accident, at noon, i.e. at midday. Most of the fragments, almost all, fell into the sea. But a number of small pieces fell close to the beach and we picked up a large amount of this material – which was light as paper. I am enclosing a sample of it. I don't

know anyone that could be trusted to whom I could send it for analysis. I never read about a flying disk being found, or about fragments or parts of a disk that had been picked up. Unless the finding was made by military authorities and the whole thing kept as a top-secret subject. I am certain the matter will be of great interest to the brilliant columnist and I am sending two copies of this letter – to the newspaper and to your home address. From the admirer (the signature was illegible), together with the above letter, I received fragments of a strange metal.

According to Professor Kaufmann,

The writer was definitely not a “local fisherman.” The letter was written in very good Portuguese, and we may infer that the writer was well educated, and that he and some friends were visiting Ubatuba for a fishing vacation. A “local fisherman” would never have read Sued’s social column in *O Globo*, and would probably not have read any newspaper. If he had, it would have been a Sao Paulo State newspaper. Kaufmann also points out that the writer obviously knew Sued’s home address, suggesting that he may have been part of the society circle with whom Sued was associated.

The above letter was read by Dr. Olavo Fontes, a resident of Rio de Janeiro. Dr. Fontes (who passed away in 1968 at the early age of 44) was an M.D. and chief of the gastroenterology section of the National School of Medicine in Rio de Janeiro. He was also an investigator of UFO reports. Fontes telephoned Sued and arranged to visit Sued in his apartment that same day. Fontes asked if he could take possession of the samples, to which Sued readily agreed. Fontes has described the material shown him by Sued in his apartment as follows:

“I saw the samples sent by the unidentified correspondent - three small pieces of a dull-gray solid substance that appeared to be a metal of some sort. Their surfaces were not smooth and polished, but quite irregular and apparently strongly oxidized. ... The surface of one of the samples was shot through with almost microscopic cracks ... The surfaces of all samples was covered in scattered areas with a whitish material. These whitish smears of a powdered substance appeared as a thin layer. The fine, dry powder was adherent but could be displaced easily with the nail. ... Mr. Sued said the material appeared to be lead at first sight - because of the gray color – but I could see that it could not be lead ... the material was light ... almost as light as paper.”

The above excerpt is taken from a report that Fontes sent to APRO (the Aerial Phenomenon Research Organization, Tucson, Arizona) on November 30, 1957. This report was subsequently reproduced, with minor revisions and excisions, as an article (Fontes 1962) in a book by Coral Lorenzen (1962). Fontes was affiliated with APRO, of which Coral Lorenzen and her husband Jim Lorenzen were the founders and directors. It appears, from his article and from APRO files, that Fontes took possession only of the material that had been sent to Sued’s apartment. There is no indication that he took possession either of the letter Sued had received at his home, nor the duplicate letter with additional specimens that had been sent to Sued’s office. This has proved to be an unfortunate oversight. From information provided by Fontes, there is no way to be sure that the specimens did originate near Ubatuba (which is why they are here referred to as the “Brazil magnesium”), no way to be sure that they originated in an aerial event, and no way to be sure that the event (if it occurred) happened in 1957. These questions have been pursued by Professor Kaufmann. The results of his investigations will be presented in a separate article. In the present article, we discuss the results of composition analyses of the specimens.

Fontes received from Sued three specimens, that he refers to as “Samples 1, 2 and 3.” Photographs of Samples 2 and 3 are reproduced as Fig. 1 of Fontes (1962). Their lengths were about 1/4 inch and 3/4 inch, respectively. Sample 1 was never photographed.

Fontes first took the specimens to the Mineral Production Laboratory in Rio de Janeiro, a Division of the National Department of Mineral Production in the Agriculture Ministry of Brazil, where they were delivered to Dr. Feigl, the Chief Chemist. Feigl’s assistant, Dr. David Goldsheim, made a preliminary examination of a chip of Sample 1, and determined that it was a metal. Sample 1 was then divided into several pieces. Two were left with the laboratory, and Fontes retained the rest (together with Samples 2 and 3). Goldsheim sent one piece of Sample 1 to the Spectrographic Section of the Mineral Production Laboratory, where it was investigated by Dr. Luisa Maria A. Barbosa, a chemical technologist, using a Hilger mass spectrograph, model DMA 1-412 (a high-quality instrument). In her report dated September 24, 1957 (Fig. 2B of Fontes 1962), Barbosa states

The spectrographic analysis showed the presence of magnesium (Mg) of a high degree of purity and absence of any other metallic element.

Fontes asserts that the sensitivity of the spectrograph was 1 ppm (one part per million), but it is not clear whether or not Fontes is quoting the analyst in making this statement. It is important to note that the Hilger mass spectrograph evaporates the material in an arc discharge and is therefore destructive. Fontes received a copy of the spectrogram, which is reproduced as Fig 2C of his article.

One of the pieces of Sample 1 was sent to the Laboratory of Crystallography of the Geology and Mineralogy Division of the National Department of Mineral Production. An X-ray diffraction analysis was carried out by Dr. Elysiario Tavora Filho (then a Professor of Mineralogy at the National Chemical School). The results of these tests are reported in Fontes' article. This test was presumably non-destructive.

At Fontes' request, a second spectrographic analysis of Sample 1 was carried out by Mr Elson Texeira at the same laboratory, using the same Hilger spectrograph. The spectrogram from Texeira's analysis is reproduced as Fig. 3B of Fontes (1962). Texeira's report, reproduced as Fig. 3A of Fontes (1962), reads in part:

The spectrographic analysis identified the unknown metal as magnesium (Mg), and showed it to be absolutely pure -- as it can be concluded from the study of the spectrographic plate taken with the Hilger spectrograph. No other metal or impurity was detected in the sample analyzed; even the so-called 'trace elements,' usually found with any metal, were not present.... A comparison... between the spectrum of the unknown metal and that of a chempur magnesium salt ... demonstrated the extreme purity of the metal in the sample... Even impurities that might exist in the carbon rod used as electrode (i.e., traces of Mn, Fe, Si, and Ti), sometimes appearing as contaminants, were not detected in this case.

This appears to be the origin of the assertion, frequently repeated, that Sample 1 was "absolutely pure." This statement has been repeated many times in the UFO literature, with the implication that the material was extraterrestrial in origin. Fontes (1962, p. 115) states:

On the basis of this evidence, it is highly probable the metallic chunks picked up on the beach near Ubatuba, in Sao Paulo, Brazil, are extraterrestrial in origin.

However, the details of Texeira's report do not support his assertion that the specimen was "absolutely pure," since his report also contains the following statement:

A comparison was made between the spectrum of the unknown metal and that of a chempur [sic] magnesium salt. It showed clearly that they were identical -- in fact, all their spectrum lines corresponded with each other. This demonstrated the extreme purity of the metal in the sample.

It appears, from this statement, that Texeira was claiming only that the specimen he analyzed was comparable in purity to a "chemically pure" specimen he had in his laboratory. Such a specimen is not 100% pure. As a gauge of the purity of magnesium specimens then available, we may refer to Fontes (1962) who wrote (p. 115):

The ASTM standard of purity for magnesium (ASTM 4-0770) shows in spectrographic analysis the following impurities: Ca 0.1%; and traces of Al, Cu, Fe and Si.

Here, as elsewhere in studying the Brazil magnesium, we are left with a puzzle: even if Texeira had used the ASTM standard for comparison, analysis by the Hilger spectrometer should have shown the presence of calcium, at least, since that spectrograph was certainly capable of detecting elements at the 0.1% (1,000 ppm) level.

Texeira's report raises another puzzle, when he states:

Even impurities that might exist in the carbon rod used as an electrode (i.e. traces of Mn, Fe, Si and Ti), sometimes appearing as contaminants, were not detected in this case.

One would like to know why the Hilger spectrograph did not show the usual contaminants from the carbon rod. Clearly, there is the possibility that the Hilger spectrometer malfunctioned, but it would be surprising if a similar (presumably rare) malfunction had occurred for both the Barbosa and Texeira analyses.

On November 4, 1957, Fontes gave one of the remaining pieces of Sample 1 to Major Roberto Caminha of the Brazilian Army, who had the specimen analyzed at the IMT (Military Institute of Technology). A few months later, Fontes gave another piece of Sample 1 to Commander J.G. Brandao of the Brazilian Navy; this specimen is believed to have been analyzed at the Navy arsenal in Rio de Janeiro. Neither piece was returned, and Fontes received no information about any analyses that were made at either laboratory.

In her book (Lorenzen 1962), Coral Lorenzen adds an interesting postscript to Fontes' report, dealing with his later attempts to track down the person who sent the material to Sued, and with evidence of military interest in the Brazil magnesium. Her postscript reads in part:

The identity of the witnesses to the original incident remains unknown. In an attempt to locate them, Dr. Fontes and Joao Martins canvassed the beach area in the neighborhood of Ubatuba. Eventually they located a fisherman who remembered a group of vacationers from an inland town who told of the incident and displayed pieces of gray substance to support their story. He could remember nothing else of value except that they were excited and talked eagerly of their experience. This information might only serve to deepen the mystery, except for this fact: during 1958 when Dr. Fontes was in the midst of his investigation of the strange metal he was visited by two members of a Brazilian intelligence agency. These two individuals at first made veiled threats of what might happen to him if he continued his inquiry into matters that "did not concern him." When it became apparent that Fontes could not be coerced into silence, they appealed to his "better judgement" to cooperate with them and turn all his notes and the strange metal over to them. [Fontes declined this request.]

In late 1957, Fontes conveyed the remaining piece of Sample 1, and also Samples 2 and 3, to the Lorenzens at APRO. If the piece from Sample 1 had been carefully identified and preserved, and subsequently tested non-destructively, this could have put an end to the speculation that Sample 1 differed from Samples 2 and 3, and that Sample 1 was "100% pure," in the sense that it contained absolutely no impurities. As it is, no specimen that was in APRO's possession was ever shown to be 100% pure.

Coral Lorenzen (1962) recounts their experience in trying to get part of the material analyzed by a U.S. Air Force laboratory:

Soon after receiving the samples from Dr. Fontes, APRO submitted a portion of a sample to an Air Force spectrographic lab for analysis. An "emission spec" was requested. The following day the emission spectrograph operator reported that he had accidentally burned the entire sample without obtaining an exposed plate. He requested another sample. APRO declined.

The Lorenzens were able to make an informal arrangement with an APRO member, who was a theoretical physicist at a national laboratory, for an analysis to be made at that laboratory. The physicist secured the assistance of a physical chemist, a chemist specializing in spectrographic analysis, and a metallographer. A spectrographic analysis of Sample 2 was carried out on September 18, 1958, by means of an Applied Research Laboratories two-meter spectrograph with a dispersion of 5 Angstrom per millimeter. The spectrographic analyst confirmed that magnesium was the major ingredient, but he detected aluminum, silicon and iron in the 100 to 1,000 ppm range (see Table 1). Lorenzen's colleague wrote that "as far as this writer has been able to ascertain, no commercial alloy of magnesium exists with a composition at all like that of the sample. The metal of the sample is of no conceivable use for mechanical purposes, or for the conduction of electricity."

Mrs. Coral Lorenzen also arranged for part of Sample 2 to be spectroscopically analyzed by the Dow Chemical Corporation. The results of their analysis were transmitted in a letter dated December 15, 1961, to Mrs. Lorenzen from Dr. R.S. Busk, Research Director of the Dow Metal Products Department of the Dow Chemical Company, Midland, Michigan. Busk's analysis (Table 1, Dow Sample 2) indicates that calcium is present at 100 ppm, and strontium and barium each at 30 ppm. It should be noted that these results have been misrepresented in the UFO literature. W.W. Walker and R.W. Johnson prepared a report for APRO in 1969 - 1970, but their report was not published until 1992 (Walker & Johnson 1992), when it appeared in the Journal of UFO Studies with an introduction by Swords (1992). Unfortunately, Walker and Johnson misread Dr. Busk's table, so that entries in their version of the Dow analysis are all too high by a factor of 100.

In 1967, the Lorenzens contacted Dr. Edward U. Condon, who was serving as director of the Colorado Project, to examine UFO evidence under contract with the U.S. Air Force. Analysis of the Brazil magnesium specimen was assigned to Dr. Roy Craig, who has given a narrative account of his experiences with the Colorado Project (Craig 1995). The results of his investigations into the Brazil magnesium are summarized in the Condon Report (Condon & Gillmor 1969, pp. 94 - 97).

According to Craig, he contacted and visited Dr. Busk early in 1968. Busk informed Craig that Dow had, for about 25 years, produced a number of batches of very pure magnesium by the process of repeated sublimation, and provided him with a specimen of triply sublimed magnesium. Craig was advised that the most sensitive tests for impurities would be neutron activation analysis. He therefore arranged to take a specimen of the Brazil magnesium and (for comparison) a specimen of the Dow triply sublimed magnesium, to the Alcohol, Tobacco, and Firearms Laboratory, Washington, D.C. This visit took place on February 5, 1968, and the specimen was analyzed by Mr. Maynard J. Pro, whose report on the analysis was mailed to Craig on February 29, 1968.

The results of Pro's analysis of the Brazil specimen and of the Dow specimen are included in the Condon Report (Condon & Gillmor 1969, pp. 94 - 97). They are summarized in Table 1. Clearly, this specimen of the Brazil magnesium was not "100% pure." Indeed, it was not as pure as the triply sublimed Dow specimen.

In his report, Condon comments that

... the magnesium metal was found to be much less pure than the regular commercial metal produced in 1957 by the Dow Chemical Company at Midland, Michigan. Therefore it need not have come from an extraterrestrial source, leaving us with no basis for rational belief that it did.

Like many of Condon's statements in his report (see, for instance, Sturrock 1987), this comment is not quite accurate: the specimen analyzed at the Alcohol, Tobacco and Firearms Laboratory was a piece of triply sublimed magnesium, not a piece of "regular commercial metal."

On the other hand, the results of the ATF analysis (see SU-E in Table 1) did seem somewhat unusual to the magnesium experts at the Dow Chemical laboratory. The Brazil magnesium contains significant amounts of both barium and strontium. As Craig reports

The high content of Sr was particularly interesting, since Sr is not an expected impurity made by usual production methods, and Dr. Busk knew of no one who intentionally added strontium to commercial magnesium. ... In all probability, the strontium was added intentionally during manufacture of the material from which the sample came.

Craig learned that the Dow Metallurgical Laboratory had over the years produced a number of experimental batches of magnesium containing strontium. However, there is no indication that any of the batches contained exactly the same impurities as those found in the Brazil magnesium.

Dr. Donald Beaman and Dr. Laurence Solaski of the Dow Chemical Company, during a meeting with the author on January 17, 1983, also expressed surprise at the presence of strontium in the specimens. They pointed out that the strontium would have to have been added, since it is not a "natural" impurity in magnesium production. Dr. S. Lawrence Couling, of the Battelle Columbus Laboratories, expressed a similar opinion during a telephone conversation with the author on May 11, 1984. He remarked that the presence of strontium in magnesium metal is "very, very unusual." He did not know of any place in magnesium technology where strontium is used.

I became interested in the Condon Report in 1976 and prepared an evaluation of that report that was subsequently published in this journal (Sturrock 1987). I thereby became interested in the only material that had been investigated by the Colorado Project, namely the Brazil magnesium specimens. With the kind cooperation of the Lorenzens, I was able to arrange for some analyses in California. The most useful of these was also the first. I was able to arrange for an isotopic analysis to be carried out at the Division of Geological and Planetary Sciences of the California Institute of Technology, Pasadena. In October 1976, Mr. Typhoon Lee and Dr. P.A. Papanastassiou performed a mass-spectrographic analysis aimed specifically at determining the isotopic composition of the magnesium (Lee & Papanastassiou 1976). They were able to determine that, with an accuracy of 0.04% (400 ppm), there is no significant difference between the isotopic composition of the specimen I had provided and that of normal terrestrial magnesium that had been subjected to normal fractionation processes such as sublimation.

Through the kind cooperation of M. Jean-Jacques Velasco of the French space agency CNES (Centre National d'Etudes Spatiales) in Toulouse, I was able to arrange for an independent determination of the isotopic ratio. This was carried out in 1986 by Professor J.C. Lorin and Dr. A. Havette of the Laboratoire de Mineralogie-Cristallographie of the Pierre and Marie Curie University in Paris. Their report (Lorin & Havette 1986) confirmed that the isotopic composition of the specimen they analyzed differs from the normal terrestrial composition by less than 0.2% (2000 ppm). Lorin and Havette also determined that the specimen contained calcium at 8,500 ppm and strontium at 700 ppm.

The Lorenzens kindly transferred ownership of the remaining specimens to me in 1987. It should be noted that, by that time, the association of the remaining specimens with the original three specimens (A, B and C), had been completely lost. The specimens had not been carefully protected and tracked. In my discussions with the Lorenzens, I learned that two specimens were out on loan. One was in the possession of Mr. Robert Achzehnov of Costa Mesa, California; I subsequently retrieved this specimen from Mr. Achzehnov in 1986. The other has a more interesting history.

Mr. Harold Lebelson, a journalist, had expressed an interest in the Brazil magnesium in 1978. As a result, a specimen (the same specimen that had been analyzed by the Colorado project) was given into his care by the Lorenzens. He took this specimen to Professor Robert E. Ogilvie of the Metallurgy Department at MIT. The results of Ogilvie's analysis were reported by Lebelson in an article in OMNI magazine (Lebelson 1979), which reads in part:

The specimen was examined by metallographic analysis to determine its mechanical and thermal history. Electron probe microanalysis was employed to determine the chemical composition and the distribution of elements within the specimen. Results of these tests showed the metal to be pure magnesium. No impurities or alloying elements, such as aluminum, zinc, manganese, or tin, were found. An oxygen x-ray map picked up magnesium and oxygen x-ray signals, thus confirming the network to be magnesium oxide.

"My conclusion," says Ogilvie, "is that the specimen from Brazil has a composition that would be found in magnesium weld material. However the structure is indeed unusual. In my opinion it could only have been

formed by heating the magnesium very close to its melting point in air. It would be necessary to hold the temperature for only a minute or so. This would produce an oxide coating on the material, which is clearly visible. Also, oxygen would diffuse down the grain boundaries, thereby producing the oxide network. It is therefore quite possible that the specimen from Brazil was a piece of weld material from an exploding aircraft or a reentering satellite."

The first part of this report is not accurate. I visited Ogilvie and discussed his analysis with him in June 1982, when he informed me that he had in fact detected impurities in the Brazil specimen, including calcium at a few thousand ppm, and strontium, iron and zinc at lower concentrations..

In 1986, with the agreement of the Lorenzens, I contacted Ogilvie to see if I could take possession of the specimen he had been analyzing. However, on telephoning him, I was dismayed to learn that he no longer had the specimen. According to Ogilvie, Lebelson had telephoned him in 1984 and advised him that someone would visit Ogilvie on Lebelson's behalf to retrieve the specimen. Soon thereafter, a gentleman turned up at Ogilvie's laboratory and took possession of the magnesium. Ogilvie did not recall the person's name, did not check his credentials, and did not ask for a receipt. All that Ogilvie could remember about the visitor was that he said he was from the IBM plant in Fishkill, New York. I telephoned Lebelson to ask what had happened to the magnesium as I wished to retrieve it, but Lebelson responded that he had never telephoned Ogilvie to authorize anyone to pick up the specimen. So, another piece of the Brazil magnesium was lost.

Ogilvie more than once recounted to me a conversation with Beaman who, according to Ogilvie, had told him that, in the late 1950s, an Air Force lieutenant brought a magnesium specimen from Ubatuba to his laboratory for analysis. Beaman had found calcium, strontium, and other elements in the specimen. The officer took away all records, putting them in a briefcase that was chained to his wrist. However, when I later asked Beaman about this episode, he stated that it had never happened.

During our conversations, Ogilvie made a very interesting suggestion. He pointed out that the Brazil magnesium seemed to originate in an event that occurred in September 1957, only one month before the Russians launched Sputnik One (October 4, 1957). Ogilvie hypothesized that the Russians had attempted to launch a Sputnik (that he referred to as "Sputnik Zero") in September, but it did not make the required orbit, and crashed near Ubatuba. This seemed a plausible hypothesis, since it would explain the apparent interest of military and intelligence agencies in this material. However, I addressed an inquiry to Dr. Vladimir Rubtsov of the Research Institute on Anomalous Phenomena in Kharkov, who replied as follows:

The "Sputnik Zero" hypothesis is, probably, worthy of examination, but I personally doubt it. The Sputnik One was made, as far as I know, of aluminum alloy. Magnesium alloys are used in space technology, but not pure magnesium. Now practically everything in the history of Soviet space explorations (including failures) seems to be revealed. If there had existed a "Sputnik Zero", it would have been a noticeable sensation in our mass media. I did not notice such a sensation and can therefore conclude the "Sputnik Zero" never existed.

In 1999, I finally acquired a sample of magnesium produced in Russia in the 1950s. The results of my comparison of the Russian magnesium and the Brazil magnesium are given in Section 3.

In 1977, there was an interesting exchange of correspondence between the President's Science Advisor, Dr. William Press, and the Administrator of NASA, Dr. Robert Frosch. This exchange was unusual in that it was released to the news media. In a letter dated September 14, 1977, Press advised Frosch that the White House was receiving inquiries about UFO reports and asked if NASA would be willing to investigate the subject. (Footnote 2) As reported by Professor Richard C. Henry (1988) of Johns Hopkins University, who had been working temporarily at NASA Headquarters for the period in question, this request was duly considered at NASA Headquarters. On December 21, 1977, Frosch replied to Press declining to initiate a new study but stating, in part,

In response to your letter of September 14, 1977, regarding NASA's possible role in UFO matters, we are fully prepared at this time to continue responding to public inquiries along the same lines as we have in the past. If some new element of hard evidence is brought to our attention, in the future, it would be entirely appropriate for a NASA laboratory to analyze and report upon an otherwise unexplained organic or inorganic sample; we stand ready to respond to any bona fide physical evidence from credible sources. We intend to leave the door clearly open for such a possibility.

At that time, I had little understanding of the operation of government agencies. I took the offer at face value, and wrote to NASA to ask where such material should be submitted. These inquiries led me to meet with Mr. David Williamson, Jr., of "Code AX, Special Projects." After discussing two or three items that might be analyzed at NASA centers, Williamson agreed to arrange for the analysis of a specimen of the Brazil magnesium. This specimen was forwarded to Dr. Richard Williams at the Johnson Space Flight Center, Houston, Texas. I had several telephone conversations with Dr. Williams. I attempted to find out just what kind of machine he would be using and its sensitivity. He was not too precise in his answers. I learned that it was "an old ARC machine," and that the sensitivity was not very good, not as good as other machines then in existence. When pressed, Williams guessed that his instrument should be able to detect impurities with abundances of 100 ppm or more.

In due course, I received a letter dated December 15, 1981 from Williams, giving the results of his analysis. His letter reads, in part,

We have finally completed our look at the Brazil magnesium sample. The SEM [Scanning Electron Microscope] with EDAX [Energy Dispersive Analysis of X-rays] has proved to be the best way to examine the sample. ... The metal ... is essentially pure magnesium. I have also enclosed a copy of the mass spectrum obtained on our ion microprobe mass analyzer (IMMA). ... When we drilled deeper into the sample than 1 micron, we saw only Mg and various interferences. The spectra, with the exception of the Fe and Ti near the surface, is [sic] the same as we obtain from commercial, high-purity magnesium wire which we use as a standard.

Our EDAX analysis should be sensitive at about the 0.1% (1,000 ppm) level; our IMMA analysis at the 100 – 1 ppm level depending on the mass. Our essential conclusion is that the specimen behaves like commercial, high-purity magnesium which has had its surface contaminated by handling, and which has been exposed to a "plastic" potting compound which appears to be the source of the Ti, Si, and possibly the Fe.

When I reported these results to Ogilvie at a later date, he remarked laconically "I'm afraid their system isn't very good."

I made several other attempts to get accurate composition analysis of the Brazil specimens, without great success, until I was able to commission analyses at commercial laboratories. In subsequent sections, I report the results of analyses carried out at the laboratories of Elemental Research Inc. in Vancouver, Canada.

Several other analyses of the Brazil magnesium have been carried out over the years, due to the generous cooperation of the Lorenzens. One notable analysis is the metallurgical investigation carried out in 1970 by Walter W. Walker, then Associate Professor of Metallurgical Engineering at the University of Arizona, Tucson, and Dr. Robert W. Johnson, then Development Metallurgist in the Advanced Materials Division of the Materials Research Corporation in Orangeburg, New York. Their report was finally published in 1992 (Walker & Johnson 1992) in the Journal of UFO Studies. The same issue of that journal also contains a valuable historical introduction to the Brazil magnesium by Michael D. Swords (1992), Professor in the General Studies Department at Western Michigan University in Kalamazoo, and a commentary by Walker (1992) reviewing the available information about the material.

2. SURFACE ANALYSIS

Fontes (1962), in describing the specimens that he acquired from Sued, commented on their appearance as follows: "three small pieces of a dull gray solid substance...Their surfaces were not smooth and polished, but quite irregular and apparently strongly oxidized....the surfaces of all samples were covered with a whitish material....The fine, dry powder filled the fissures and cracks on the surface of the first sample." It is not easy to reconcile the gray appearance of the specimens with the writer's account of their origin. If a magnesium object were suddenly fragmented, the fragments would be shiny, not dull gray. Magnesium becomes dull only slowly. In a reasonably dry climate, it remains shiny for months and even years. In a damp climate, it will corrode more rapidly.

However, if a complex device were to explode, the metal parts may well be contaminated by material from parts that were not constructed of magnesium. Furthermore, the person who sent the letter and specimens to Sued had claimed that the event occurred near the water's edge (in or near Ubatuba). If this were the case, it is possible that magnesium fragments were heated to a high temperature and then dropped into sea water. They might then acquire a coating of minerals from the sea water and from the sand, and this could account for the whitish-gray surface material.

As a result of this speculation, it appeared that it would be worth while to determine the composition of material on the surface of the specimens. If it were found that the surface abundances were a good match to the element abundances of sea

water and of the sand on one of the beaches in the Ubatuba area, that would tend to corroborate the writer's story, and it might even help identify the actual location, since different beaches in that area have different types of sand.

In April 1978, the surface composition of one of the specimens (SU-D) was determined by analyst Mr. Chris Zercher of the Center for Materials Research at Stanford University using a KEVEX electron microprobe. (Footnote 3) Zercher found that the principal constituent was magnesium, but detected calcium, chlorine, iron, silicon and titanium, each at about 2,000 ppm. The material was also analyzed by a Laue diffraction analysis, and found to be mainly $Mg(OH)_2$.

More recently (January 1997), Professor Michael Kelley, also of the Center for Materials Research at Stanford University, carried out a similar analysis using an XPS (X-ray Photoelectron Spectroscopy) instrument, but this proved to be much less sensitive than we required, and he was able to identify only a few elements. According to Kelley, the gray surface material contains the following elements: oxygen 22.9% (by number), magnesium 10.6%, carbon 66.1% and chlorine 0.4 %, indicating the presence of MgO and $MgCl_2$. (Note that some elements - including oxygen, carbon and chlorine do not show up in the positive-beam analyses that were used in the SIMS-type (Secondary Mass Ionization Spectrometer) instruments to be discussed later.)

On consulting Dr. Robert Odom, Manager of Contract Research at Charles Evans and Associates, Redwood City, California, in the spring of 1997, I was advised that the most sensitive surface analysis would be provided by a device developed in that laboratory that is referred to as ToF-SIMS (Time-of-Flight Secondary-Ion Mass Spectrometer). The top monolayer of the surface of the specimen is zapped with a beam that is pulsed, the pulse duration being of order one nanosecond. Ions produced in this way are accelerated by an electric field, travel some distance, and are analyzed by a mass spectrometer, taking into account the different flight times of ions of different mass. Information from the mass spectrometer, which yields the mass-to-charge ratio, is registered as a function of time. This procedure, which has a sensitivity of better than 1 ppm, is regarded by the analysts as a qualitative technique for determining the composition of the top 1 – 4 monolayers. By comparison the analysts regard ICP (inductively-coupled-plasma) instrumentation as capable of providing quantitative information about the bulk composition of specimens.

Of course, surface analysis can be carried out only on specimens that have not yet been mounted and polished, and several of the Brazil magnesium specimens have at various times been mounted and polished for analysis. This led me to select specimens SU-C and SU-D for ToF-SIMS analysis. The results are shown in Table 2. The instrument gives the “intensity” of measurements of the various elements relative to magnesium.

There are significant differences between the surfaces of SU-C and SU-D. For instance, the abundances of lithium, sodium and titanium in SU-C are about ten times the levels of the same elements in SU-D. Furthermore, SU-C shows a significant trace of palladium, that was not detected in SU-D. It is clear that, judging from the surface composition, the specimens are not homogeneous.

With the kind cooperation of Professor Kaufmann, I was able to obtain samples of sands from two beaches in the neighborhood of Ubatuba: Praia Anchieta and Praia Enseada. These were analyzed by Dr. Hugh Gotts of the Materials Analysis Group at Philips Semiconductors in Sunnyvale, California, on March 28, 1997. The samples were dissolved in a mixture of aqua regia and hydrofluoric acid and analyzed for bulk elemental composition by means of a Thermo-Jarrell-Ash AtomScan 25 ICP [inductively coupled plasma] Optical Emission Spectrometer (ICP-OES). The instrument was calibrated using standards containing 0, 1, 3 and 5 ppm of each element. The calibration was then verified by running quality-control standard solutions containing 1 ppm of each element. In addition, to assure that there was no instrumental drift during the analysis, several standard zeroes and 1 ppm standards were interspersed with the extracts.

Table 2 shows the bulk abundances of elements in seawater and in sand from these beaches, for the same elements that are found at a level of 10 ppm or more in the surface impurities of SU-C and SU-D. Although the sodium and calcium in SU-C and SU-D may have originated in seawater and sand, it is clear that most of the impurities in the surface material cannot be explained in that way. It is also notable that the sands in the Ubatuba area have a high iron content, but the iron content of SU-C is comparatively low, and the iron content of SU-D is undetectable.

Later in 1997, I became aware of the capabilities of the Elemental Research laboratories in Vancouver, British Columbia, Canada, including a laser-ablation inductively-coupled-plasma mass spectrometer that can give abundances with high sensitivity and consumes only amounts of order 1 micrometer³ (10⁻¹² cm³). I originally planned to use their services for internal analysis, but I learned that their instrument could be used also for analysis of the top few micrometers of a surface. I therefore arranged for them to carry out these surface analyses of two specimens that had been sent to them for internal analysis: SU-Ib and SU-Ja. The results of their analysis are also given in Table 2. We see that these two specimens differ from each other, and also from SU-C and SU-D.

On comparing SU-Ib and SU-Ja, we see that, except for silicon, calcium, chromium, zinc and selenium, SU-Ja has lower impurity levels than SU-Ib; of these elements, silicon and calcium could have been derived from sand.

Comparing SU-Ib and SU-Ja with SU-C and SU-D, we see that boron, phosphorus, and zinc are present at a higher level in SU-Ib and SU-Ja than in SU-C or SU-D; on the other hand, lithium, strontium, and niobium are present at lower levels in SU-Ib than in SU-C and SU-D. This suggests that different specimens have experienced different environmental conditions, either in their original setting, or in subsequent handling and storage. Although some of the surface impurities (such as sodium and calcium) may have been derived from seawater or sand, other elements (such as titanium, chromium, iron, cobalt, selenium, strontium, yttrium, niobium, palladium and barium) are more likely to have had a technological origin.

3. BULK ANALYSIS

In the early 20th century, magnesium was produced commercially in Austria by the carbothermic reduction of magnesium oxide that was obtained from calcined magnesite, and in Germany by the electrolysis of magnesium chloride, obtained from potash and from carnalite. The Pidgeon ferrosilicate thermal technique, developed in Canada in 1941, uses ferrosilicon and calcined dolomite. The electrolytic process, that is now generally used, produces magnesium that is typically 99.9% pure. In the United States in the 1950s, most magnesium was produced by the electrolysis of magnesium chloride prepared from seawater off the coast of Texas (Krenzke, Hays & Spell 1957).

With the kind cooperation of M. Jean-Jacques Velasco of the French space agency CNES, I arranged in 1986 for a specimen of the Brazil magnesium, then in my possession, to be analyzed by Professor J.C. Lorin and Mme. A. Havette of the University of Paris. Lorin and Havette used a Cameca SIMS (secondary ion mass spectrometer) instrument. They detected calcium at the 8,500 ppm level, substantially higher than levels previously quoted. They also detected strontium at 700 ppm, similar to the level found by the Colorado Project (see Table 1).

In 1997, I arranged for new analyses of some of the specimens then in my possession. I began with SIMS analysis at a local laboratory, but the analyst found that the results were erratic. He ascribed this to the fact that the samples had not been properly mounted. He advised me that, to get meaningful results from SIMS analysis, it would be necessary not only to mount and polish the specimens and cover them with conductors such as carbon or gold, but also to have some independent information as to the likely impurities. It therefore became clear that SIMS analysis was not the optimum procedure.

I learned that the Elemental Research laboratories in Vancouver, Canada, is one of the few laboratories in the world that have a laser ablation ICP-MS instrument. I was advised that this instrument can provide measurements at the 1 ppm level or better, using only a micron-cube of a specimen, over the complete range of atomic numbers.

In September 1997, I arranged for Elemental Research to analyze two samples, SU-Ia and SU-H. They also analyzed, at the same time, the following comparison samples: Dow CP-d (part of the Dow sample provided to, and analyzed by, the Colorado Project); ALFA-a and ALFA-2a (two samples of very pure magnesium purchased from the ALFA Corporation, Ward Hill, Massachusetts); and ISO-A (a sample of isotopically certified magnesium purchased from National Institute of Standards and Technology [NIST]). The Dow specimen was generously made available to me by Dr. Roy Craig, who had been responsible to the analysis of the Brazil magnesium on behalf of the Colorado Project. The results of these analyses are shown in Table 3, where I display all elements for which there was a non-zero measurement for any one of those six specimens.

There is good agreement between the measurements of the composition of SU-Ia and SU-H, except that silicon shows up in SU-H and not in SU-Ia, and titanium appears to be more abundant in SU-Ia than in SU-H. Calcium was detected at the 3,000 to 5,000 ppm level, which is similar to the estimate made by the analysts at the University of Paris. Strontium was found to be present at 600 to 900 ppm, and barium at about 300 ppm; this result is approximately consistent with the results of the Colorado Project analysis. Ignoring estimates below 1 ppm, we see that barium appears (at 15 ppm) in only one of the comparison specimens, and strontium in none of the comparison specimens.

As in our analysis of the surface composition, we note that the major impurities are calcium, strontium and barium, in that order. These all belong in the same column (column 2) of the Periodic Table as does magnesium. This suggests that the Brazil magnesium was produced from material that contained not only magnesium but also calcium, strontium and barium.

As mentioned in Section 1, Professor Robert Ogilvie of the Massachusetts Institute of Technology suggested to me that the Brazil magnesium may have come from the crash of an attempted launch of a Sputnik by the USSR before the first successful launch of Sputnik One in October 1957. Ogilvie referred to this hypothetical spacecraft as "Sputnik Zero." I

have made inquiries into this possibility, and I have been advised by contacts in Russia that no such event occurred. However, I decided to compare the composition of the Brazil specimens with magnesium produced in the Soviet Union. Through the kind cooperation of Dr. Pavel Detkov of the Solikamsk Magnesium Works in Solikamsk, in the Perm region of Russia, I obtained information concerning the primary impurities of high-quality magnesium produced in the Soviet Union in the 1950s. Another correspondent in Russia kindly obtained for my analysis a small sample of magnesium alloy used in 1950-era MIG aircraft. Table 4 shows impurities in SU-H, ALFA-2a, ISO-A, a Solikamsk specimen, and the MIG specimen, as determined by analysis at Elemental Research. We see that SU-H has higher levels of boron, calcium, strontium, and barium than the other four specimens.

It appears that the Solikamsk magnesium has very low impurity levels, comparable with those of the ALFA specimen. It is notable that there is no trace of either strontium or barium in the Solikamsk magnesium. The MIG material is basically a magnesium-aluminum alloy, and is therefore quite different from the Brazil magnesium. The MIG material contains only traces of strontium and barium. Clearly, the composition of the Solikamsk magnesium and of the MIG magnesium-aluminum alloy provides no support for Ogilvie's interesting hypothesis that the Brazil magnesium came from the crash of a Russian spacecraft that preceded Sputnik One.

4. ISOTOPIC ANALYSIS

There has been sustained interest in the isotopic composition of the Brazil magnesium. An anomalous isotopic composition would be the strong evidence for an extraterrestrial origin. This possibility was of interest to Dr. Craig, who arranged for the neutron activation analysis carried out at the National Office Laboratory, Alcohol and Tobacco Tax Division, Bureau of Internal Revenue, on behalf of the Colorado Project (Condon & Gillmor 1969). The neutron activation analysis could be used to make an estimate of the percentage composition of ^{26}Mg and it was found that the abundance of this isotope did not differ significantly from other magnesium specimens (Condon & Gillmor 1969).

As mentioned in Section 1, in December 1975 I arranged to have a specimen of the Brazil magnesium analyzed at the Meteoritic Laboratory of Professor Gerald Wasserberg of the California Institute of Technology. I received a report from Dr. Typhoon Lee and Dr. D.A. Papanastassiou in October 1976. Lee and Papanastassiou did not provide me with their raw data, nor with separate estimates of the abundances of the three isotopes (^{24}Mg , ^{25}Mg , and ^{26}Mg), but they did present an analysis of their data indicating that the measurements were consistent with fractionation of normal magnesium. When magnesium is heated, it tends to lose the lighter isotopes preferentially: the change in the abundance ratio $^{26}\text{Mg}/^{24}\text{Mg}$ should be twice the change in $^{25}\text{Mg}/^{24}\text{Mg}$. Lee and Papanastassiou informed me that their measurements were a close fit to this expectation.

More recently, I have attempted to obtain precise measurements of the isotopic composition of the Brazil magnesium, but this has not been easy. The first laboratory that I approached led me to believe that they could make accurate measurements by means of secondary ion mass spectrometry (SIMS) analysis, but they did not deliver on this promise.

I next turned to Charles Evans and Associates in Redwood City. They first attempted to measure the isotopic ratio using an unmounted specimen, but the results were very erratic, and they decided that it would be essential to mount the specimen, polish it, and then gold-coat it. Charles Evans and Associates also advised me that it is essential to have comparison specimens. Accordingly, I supplied their analyst, Dr. Jack Cheng, with one specimen of the Brazil magnesium (SU-A); two specimens of triply sublimed Dow magnesium that had been provided to me in the 1970s (Dow A and Dow E); a specimen that had been used at Johnson Space Center for comparison, derived originally from the Baker Company (Baker A); and part of the triply-sublimed magnesium that the Dow Chemical Company had provided to the Colorado Project in the 1960s (Dow CP). The Baker specimen was kindly provided by Dr. Williams of Johnson Space Center, and the Dow CP specimen was kindly provided by Dr. Craig of Durango, Colorado (formerly at the University of Colorado).

Charles Evans and Associates took great care in the mounting, polishing and coating of the specimens and they made a number of runs with SIMS instrumentation. The results are shown in Figure 1. The measured isotopic ratio for Dow CP is very close to that expected of normal magnesium, for which $^{25}\text{Mg}/^{24}\text{Mg} = 0.127$ and $^{26}\text{Mg}/^{24}\text{Mg} = 0.139$. The solid line in Figure 1 is the track to be expected if fractionation occurs due to heating. We see that all specimens lie on that track. It is curious that the isotopic ratios for the Dow CP specimen are quite close to the values for normal magnesium, since this specimen and also the specimens Dow A and Dow E were all produced by triple sublimation. The mechanism for the production of the Baker specimen is unknown, but it may well have been sublimation since that is the normal procedure used to purify magnesium.

We see that the Brazil specimen SU-A is the furthest from normal composition. However, it is on the same track as the other specimens. One may therefore infer that a specimen with the same isotopic composition as SU-A could be produced

from normal magnesium by multiple sublimation. Hence this analysis does not point towards a non-terrestrial origin for the specimen SU-A.

However, these results are somewhat surprising. Sublimation (or any other form of fractionation) moves the isotopic composition away from the normal ratios ($^{25}\text{Mg}/^{24}\text{Mg} = 0.127$ and $^{26}\text{Mg}/^{24}\text{Mg} = 0.139 = 0.139$), along the track shown in Figure 1. However, it also tends to purify the magnesium, although this tendency is contingent upon the sublimation thermodynamics of the ensemble of elements. One therefore tends to expect that the specimen with the most deviant isotopic composition will also be the purest specimen. However, we see that SU-A is the furthest from normal composition, but it is less pure than the DOW-CP specimen, for example. The former has high abundance of Ca, Sr and Ba, whereas the latter is almost free of these three impurities.

In addition to the abundance analyses reported in Sections 2 and 3, Elemental Research also analyzed certain specimens with greatly increased mass-to-charge resolution in the neighborhood of the values appropriate for the magnesium isotopes. The results are shown in the four panels of Figure 2. Panels (a) and (b) show the scans obtained for two specimens of the Brazil magnesium, SU-Ia and SU-H. Panel (c) shows the scan obtained for specimen ALFA-a, one of the standards used in this work. Panel (d) shows the scan obtained for specimen Iso-A, part of the magnesium isotopic standard obtained from the National Institute of Standards and Technology. We see that the isotopic compositions of these four specimens are indistinguishable: the isotopic composition of the Brazil magnesium is clearly compatible with terrestrial origin.

5. DISCUSSION

The Brazil magnesium has attracted great interest from the UFO research community for a variety of reasons that were reviewed briefly in Section 1.

- It was the only material specimen investigated by the Colorado project. The Colorado Project staff conducted a good analysis, as far as it went. However, it is regrettable that the Project did not send an investigator to Brazil. The investigator may or may not have been able to obtain more information from inquiries in the Ubatuba area. However, he could have consulted with Brazilian authorities. Such inquiries might have turned up more information about the event (if real), and the investigator would have been able to address some serious questions to the analysts at the National Department of Mineral Production. It is also likely that, even without sending an investigator to Brazil, the Project might have been able to send an inquiry through official channels, and so obtain the results of tests carried out by the Brazilian Army and Navy.

- From the very beginning, there have been claims that some of the specimens were “ultra-pure,” more pure than magnesium produced on Earth at that time, with the implication that the magnesium was of extra-terrestrial origin. These claims are very suspect. Analysis of the material that was in APRO possession was by no means ultra-pure – it contains calcium at the 1,000 ppm level. Hence the claim of ultra-purity has rested on the possibility that Sample 1 (the subject of the original analysis in Rio de Janeiro) was significantly different from Samples 2 and 3, which were sent to APRO. However, in his letter transmitting these samples, Fontes mentions that he is also enclosing a small remaining piece of Sample 1. Unfortunately, the Lorenzens did not keep a careful log of the specimens, so it is not possible at this time to identify that piece, or even to be sure that it is still part of the remaining specimens.

Furthermore, looking back on the reports prepared by the analysts at the Mineral Production Laboratory, it is clear that they did not justify Fontes' claim that Sample 1 had been found to be ultra-pure. The analysts stated that they found no impurities in the sample, but they added that neither did they find impurities in a comparison specimen, and neither did they detect the usual impurities attributable to the carbon rods. Perhaps their equipment was not working properly. Perhaps the analysts were having a bad day. Or perhaps the Laboratory was deliberately withholding information. Government agencies, both in Brazil and in the United States, seem to have been either incompetent or uncommunicative in respect to the Brazil magnesium. The Brazilian Army and Navy both withheld from Fontes the results of their tests. The US Air Force either destroyed a specimen or withheld information from the Lorenzens. An analyst at a NASA laboratory claimed that he was unable to detect any impurities either in the Brazil specimen or in a comparison specimen.

Investigators with the Colorado Project did draw attention to the presence of strontium and barium in the Brazil magnesium. According to experts at the Dow Chemical Company, no one knew of any production procedure that would lead to these impurities, and no one knew of any producer who deliberately added these elements to magnesium. It may or may not be significant that magnesium, strontium and barium all belong to the same chemical group (group 2).

Analysis of the surface material yields a rich mixture of elements, and this fact deserves further investigation. It would be helpful to get expert advice on whether these elements could arise from contamination in a natural setting (air, water, sand,

etc.), or whether they indicate that the specimens were at one time associated with materials usually found in a technological setting.

As far as one can tell from analyses carried out to date, there is no case for believing that the Brazil magnesium specimens had an extraterrestrial origin. On the other hand, it has not proved possible to identify where the material was produced.

However, composition analysis covers only one area of questioning concerning the Brazil magnesium. Inquiry into a UFO case normally involves investigation of the witness or witnesses. Unfortunately, the identity of the person who sent the material to Sued remains a mystery. At my instigation, Sued published a request for further information in his column dated August 21, 1985, but there was no response.

In an attempt to gain some information relative to the origin of the Brazil magnesium, Professor Pierre Kaufmann of Sao Paulo has carried out some inquiries in the Ubatuba area, with interesting but by no means conclusive results. These investigations will be reported in a separate article.

ACKNOWLEDGEMENTS

Many individuals and organizations have responded generously to my requests for help in the course of these investigations. In particular, I wish to thank Dr. Donald Beaman of Dow Chemical Company; Dr. Jack Cheng of Charles Evans and Associates, Redwood City, California; Dr. S. Lawrence Couling of the Battelle Columbus Laboratories; Dr. Roy Craig of Ignacio, Colorado; Professor Aldo da Rosa of Stanford University; Dr. Michael Epstein of the National Institute of Standards and Technology; Professor Pierre Kaufmann of the Instituto Presbiteriano Mackenzie, Sao Paulo; Mr. Typhoon Lee of the California Institute of Technology; Professor J.C. Lorin of the Universite' Pierre et Marie Curie, Paris; Professor William Nix of Stanford University; Dr. Robert Odom of Charles Evans and Associates, Redwood City, California; Professor Robert Ogilvie of MIT; Dr. D.A. Papanastassiou of the California Institute of Technology; Dr. Laurence Solaski of the Dow Chemical Company; Professor Michael Swords of Western Michigan University; M. Jean-Jacques Velasco of CNES, Toulouse, France; Dr. Sam Wang of Elemental Research Inc., Vancouver; Dr. Richard Williams of Johnson Space Flight Center; and Mr. David Williamson of the National Aeronautics and Space Administration. Special thanks are due to Coral and Jim Lorenzen, the founders and directors of APRO (Aerial Phenomena Research Organization) who are sadly deceased, for generously providing me with access to the Brazil magnesium specimens and to their files. I am also grateful to the referee Dr. Allen R.J. Eaglesham, whose very detailed comments and recommendations have made it possible to significantly improve upon the original submission.

FOOTNOTES

1. There have been classified studies. For instance, it is known that the Air Force commissioned classified research by the Battelle Memorial Institute in Columbus, Ohio, in the early 1950s, and that the Central Intelligence Agency commissioned a classified review by the Robertson Panel in 1953. For more on this point, or for a more general introduction to UFO history, see for instance Clark (1998) or Jacobs (1975).
2. This may have been viewed as a way for President Jimmy Carter to deliver on his campaign promise that, if elected, he would find out the truth about UFO reports and release the information to the public.
3. Since there had been no systematic tracking of specimens in the APRO files, it was convenient to adopt a new system of coding the various specimens when they were transferred from APRO to Stanford University. Specimens received from APRO were numbered SU-A, SU-B, etc. If a specimen was subdivided, its parts were coded SU-1a, SU-1b, etc.

APPENDIX 1

Transcription from O Globo, Rio de Janeiro, September 14, 1957

REPORTAGE SOCIAL DE IBRAHIM SUED

UM FRAGMENTO DE DISCO-VOADOR!

RECEBEMOS: "Prezado Sr. Ibrahim Sued. Leitor assiduo de sua coluna e seu admirador, quero proporcionar-lhe um verdadeiro furo jornalístico a respeito dos discos voadores, se e que acredita nos mesmos. Eu tambem nao acreditava no que ouvia falar e somente lia, ate ue, alguns dias atras, perto de Ubatuba, em pescaria com varios amigos, vi um disco-voador! Aproximou-se da praia em incrivel velocidade, parecendo prestes a abater-se sobre as aguas, quando, a um impulso

fantastico, elevou-se rapidamente. Atonitas, seguíamos com os olhos esse espetáculo, quando vimos o disco explodir em chamas, saindo em milhares de pedacos que pareciam fogos de artifício -- apesar de ser doze horas, ou seja, meio-dia --, com um brilho fortíssimo. Esses pedacos caíram quase todos no mar, mas muitos pequenos pedacos caíram perto da praia, tendo nos recolhido um bom numero desse material, tao leve que parecia papel. Aqui junto uma pequena amostra desse material, que nao sei a quem devo confiar para analisar. Nunca li que houvesse sido recolhido um disco-voador ou que se tivessem recolhido pedacos de um disco, a nao ser que as autoridades militares or tenham feito e usado de sigilo. Estou certo de que este assunto bastante interessara ao brilhante cronista, e mando-lhe esta em duplicata, para o jornal e para a sua residencia ...” Do admirador, (assinatura ilegível), junto, recebi detritos de um metal estranho.

APPENDIX 2

Isotopic Fractionation

Processing, such as sublimation, that involves heating the material, will lead to changes in the ratio of the abundances of the various isotopes. The lighter isotopes “boil off” more readily, so that the mixture changes in favor of the heavier isotopes. Magnesium has three stable isotopes, with atomic weights 24, 25 and 26. The evaporation rate is inversely proportional to the atomic weight, and this leads to a relationship between the three rates of change of the abundances.

If we write the fractional abundances of the three isotopes as F_{24} , F_{25} and F_{26} , and if the abundances change by δF_{24} , δF_{25} and δF_{26} , these changes will be related by

$$\frac{\delta F_{24}}{F_{24}} : \frac{\delta F_{25}}{F_{25}} : \frac{\delta F_{26}}{F_{26}} = \frac{1}{24} : \frac{1}{25} : \frac{1}{26} . \quad (B.1)$$

The normal ratios are conventionally expressed in the form

$$\frac{F_{25}}{F_{24}} = 0.127, \quad \frac{F_{26}}{F_{24}} = 0.140. \quad (B.2)$$

By manipulating these two equations, we find that the fractional changes in these two ratios are related by

$$\frac{\delta(F_{25}/F_{24})}{\delta(F_{26}/F_{24})} = \frac{(1/26 - 1/24) F_{26}}{(1/25 - 1/24) F_{25}} . \quad (B.3)$$

i.e. by

$$\frac{\delta(F_{25}/F_{24})}{\delta(F_{26}/F_{24})} = 2.12 . \quad (B.4)$$

This is the track shown in Figure 1.

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FIGURE CAPTIONS

Figure 1. Plot of the determination of the isotopic ratios $^{25}\text{Mg}/^{24}\text{Mg}$ and $^{26}\text{Mg}/^{24}\text{Mg}$, as measured by Charles Evans and Associates by SIMS (secondary ion mass spectrometry) analysis, for the following specimens: (a) DOW CP, the Dow sample of triply sublimed magnesium used by the Colorado Project; (b) DOW A, a sample of triply sublimed magnesium supplied to me by Dow Chemical Company; SU-A one of the Brazil magnesium specimens; Baker A. a magnesium standard used by Johnson Space Flight Center; and DOW E another sample of triply sublimed magnesium supplied to me by Dow Chemical Company; Specimen (a) is located closest to the idea ratios $^{25}\text{Mg}/^{24}\text{Mg} = 0.127$ and $^{26}\text{Mg}/^{24}\text{Mg} = 0.139 = 0.139$.

Figure 2. Isotopic composition as determined by Elemental Research Inc., using high-resolution mass scans of ICPM (inductively coupled plasma mass spectrometer): (a) Brazil magnesium specimen SU-Ia; (b) Brazil magnesium specimen SU-H; (c) magnesium standard

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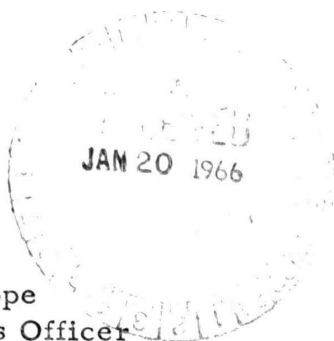
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"RESEARCH"

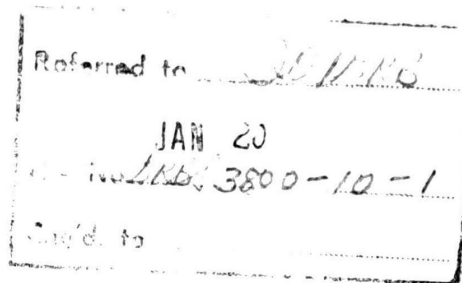
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NATIONAL RESEARCH COUNCIL
CONSEIL NATIONAL DE RECHERCHES
CANADA

OTTAWA 7.
January 18, 1966.



Mr. Charles Pope
Public Relations Officer
Defence Research Board
Cartier Square
Ottawa, Ontario.



Dear Charlie:

I am enclosing a copy of the article that was brought to my attention in connection with Unidentified Flying Objects. As I pointed out in our telephone talk, you'll note that the article, published in "Le Nouveau Samedi" on October 2, 1965, quotes "doctors B.H. Ridell and Wilbert Smith" as trying to make an analysis of "this intriguing chunk of metal." In view of the fact that Wilbur Smith died several years ago, I assume that the article is based on some warmed-up and badly garbled incident.

Sincerely yours,

John R. Kohr

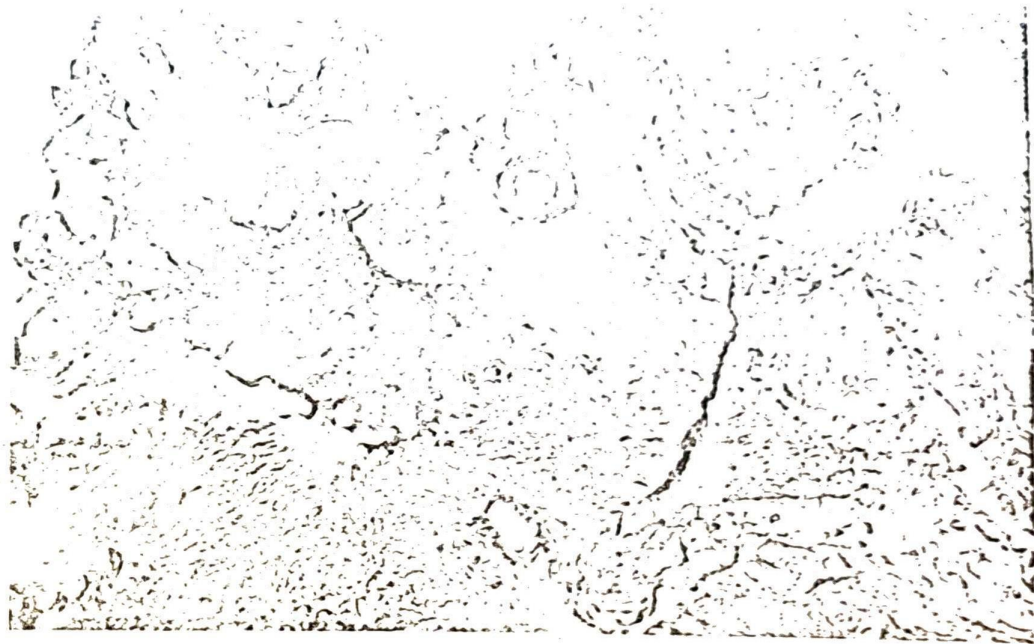
John R. Kohr
Community Relations Officer.

JRK:al

cc: Mr. A. M. Lanthier
Duplication & Stationery
M-58.

21/1/66

d'une soucoupe volante?



DE PLUS PRES, on peut voir facilement l'embouchure de ce qu'était un tuyau et la surface durcie de cet objet qu'aucun savant n'a encore pu identifier.

UL Y A TROIS ANS, un cultivateur découvrait, dans le fleuve St-Laurent, près du pont de Québec, une masse de métal qui lui semblait suspecte. Depuis plusieurs jours, à marée basse, cet "objet" attirait son attention, parce qu'il semblait anormal qu'à cet endroit non navigable, on se fut permis de déposer une telle pièce de métal.

Il a immédiatement téléphoné à l'Armée et, quelques jours plus tard, on récupérerait cet objet, mais avec grandes difficultés puisqu'il pesait huit tonnes, même si sa longueur n'était que de cinq pieds, sa longueur de trois et son épaisseur de 10 pouces. Certains spécialistes se sont penchés, si l'on ose dire, sur cette masse d'origine inconnue pour en faire l'analyse, mais sans succès.

Six mois plus tard, on la ramène à la Marine (elle avait été découverte dans l'eau, du moins à marée haute) et, au bout d'un an, les experts de notre force

navale n'avaient pas encore réussi à identifier cette masse.

De plus en plus intrigués, on l'a transportée à Ottawa, au département des recherches et ce sont les docteurs B.H. Ridell et Wilbert Smith, qui ont entrepris de tenter de découvrir la provenance de cet intrigant morceau de métal.

Après des études très poussées, en collaboration avec les géologues les plus consciencieux, il n'a pas encore été possible de percer le mystère. Non seulement ce mystère n'a pas été percé, mais toute tentative pour percer cette pièce s'est aussi avérée vaine jusqu'à présent. On a même tenté d'en extraire un morceau à l'aide d'une drille mécanique, mais en vain.

L'objet ne se transperce pas et on remarque dans sa "carapace" des trous de tuyaux, de protubérances définitivement créées par la main des hommes... ou d'un homme quelconque... où qu'il habite.

Il a été établi hors de tout doute que les matériaux constituant cet objet ne proviennent définitivement pas de notre planète. Il a aussi été démontré qu'il ne s'agit pas d'un fragment de météorite, puisqu'on connaît déjà la nature de ces fragments.

Dans les circonstances, on s'interroge dans les milieux scientifiques de la capitale fédérale, où on conserve très précieusement la "chose".

Le docteur Smith a révélé que cette masse de métal avait été analysée à la loupe et qu'on y avait identifié seulement 5% de métaux généralement connus sur notre planète. Dans ce minime 5%, on retrouve du baryum, de la silicose, du magnésium, du manganèse, du cuivre, du nickel, de l'aluminium, du vanadium, du molybdène, du cobalt, du titane et du fer. Mais, fait pour le moins étrange, aucun savant du département des recherches n'a été en mesure

d'identifier l'autre 95% de métaux. Pour eux, c'est un mystère. C'est l'inconnu.

Comment cet objet s'est-il retrouvé dans le fleuve St-Laurent? Mystère.

Comment est-il possible que, à l'aide des meilleurs outils modernes, on ne puisse pas percer, couper ou démanteler cet objet? Mystère. Il résiste à tout.

Comment se fait-il que l'on y trouve des entrées de tuyaux, des protubérances de toutes sortes? Mystère, encore une fois.

La seule conclusion qu'il est logiquement possible d'apporter à la découverte de cette "chose", c'est qu'elle provient d'un autre monde... probablement d'une soucoupe volante qui s'est désagrégée et dont une partie a pu tomber dans le fleuve St-Laurent.

Qu'est-ce que la "chose"? Seul l'avenir et les scientifiques pourront nous le dire dans un avenir plus ou moins rapproché.

19 December, 1981

Mr. George Hathaway,
Norman B. Hathaway Associates,
99 Charles St. East,
Toronto M4Y 1V2

Dear Mr. Hathaway:

I am writing concerning "Les Ecureuils Iron Mass", the location of which I informed you of last December. I do hope you have managed to have samples of this metal analyzed.

You promised that you would send me a copy of the report of the analysis, and as I have not heard from you, thought it best to check with you.

I look forward to hearing from you. Merry Christmas.

Yours sincerely,

Arthur Bray

NEW DEVELOPMENTS ON OTTAWA'S MYSTERY METAL

In our last issue, we reported that we were still awaiting receipt of the long-promised report on the tests and findings of the metal samples of the 3,000-lb. chunk of unidentified hardware. Meanwhile, that dedicated researcher, Arthur Bray, has again approached Dr. P. Millman, who heads Canadian Government UFO investigation and with whom Arthur initiated this latest request for a governmental analysis of samples of the mystery metal. Arthur now reports as follows: "To the best of my knowledge, the Geological Survey has concluded its testing, although I have no idea what tests the sample was subjected to. Whether the tests which I specifically requested were carried out, only time will tell. I have been informed verbally by Dr. Millman that Dr. Smith of Geological Survey will publish the results of the analysis in one of the scientific journals issued by the Federal Department of Energy, Mines and Resources. When this will be, is another question. Dr. Millman has promised to inform me when this has been done, and to see that I receive a copy of the journal concerned." While it is encouraging to learn that an official report may eventually appear in a government journal, the fact remains that, for the time being, we are back to square one again, still playing the "waiting game". After what is now over 10 years of governmental delaying tactics in producing this report, we may perhaps be excused if we wonder if this is yet another stalling action. However, as Arthur Bray so philosophically points out: "We may have to wait another year, but after 10 years already, what is one more?" We are certainly not discouraged - in fact, we welcome this time lag in which we can continue with our own constructive research on a private basis.

In view of this continuing situation, our metal research group has agreed to step up its efforts to obtain a larger number of individual analyses from private professional sources. When, with time, we receive all the results of these tests, we shall then be in a better position to make a thorough comparison to note similarities and/or differences and also to check them with the governmental report if and when it is finally published. Over the past year, a largish number of metal samples were sent out by our group at the request of interested parties. Arthur Bray is also continuing his own personal efforts to secure further analyses and is presently negotiating with a reputable source in the U.S.A., while our co-worker in Montreal, Mr. Ronald W.G. Anstee, is now awaiting receipt of reports of tests on the samples he sent out last year. We readily appreciate that it takes some time to perform thorough analyses, particularly as it is often a case of having to fit in such tests with other, higher-priority lab. work. However, as far as our group is concerned, the first of the reports are now beginning to trickle in, with some interesting results. For obvious reasons and until the government report is published, we are now compelled to adopt our own "silence policy" on the exact details, on a quantitative basis, of the reports received. However, for the interest of our readers, we give below some details of a preliminary report (Phase One of a Two-Phase Program) of a chemical analysis of the metal samples as carried out by Unidentified Flying Objects Researchers Alliance of 214 South Arch Avenue, Alliance, Ohio 44601, U.S.A.

RESULTS OF TESTS CONDUCTED ON: "CANADA'S MYSTERY METAL" BY UFORA PHASE ONE: DECEMBER 31, 1970.

Listed below are the results gleaned from tests conducted by UFORA's Chemistry Advisor and his associates on a sample of "Canada's Mystery Metal".

As soon as the metal was received, attempts were made to obtain smaller samples from the larger piece of metal. First attempts were made to cut the metal with a Tungsten Carbide blade, but after five minutes, it was decided that this attempt was in vain. The next avenue of thought turned to using a diamond-tipped powered saw. After 15 minutes of cutting time had elapsed, a small fragment was cut from the parent body. The piece was roughly triangular in shape with a thickness (point at which it was cut) of about three/thirty-seconds of an inch.

One of the major tests conducted on the metal was by the X-Ray ^{Vacuum} Quantometer, a non-destructive testing device. The findings of the Quantometer were as follows :

MAJOR CONSTITUENTS

Iron	(Fe)
Nickel	(Ni)
Manganese	(Mn)
Chromium	(Cr)

MINOR CONSTITUENTS

Cobalt	(Co)
Silicon	(Si)
Magnesium	(Mg)
Sulfur	(S)
Potassium	(K)

No traces were found of Aluminum (Al), Sodium (Na), Phosphorus (P) and Chlorine (Cl).

A small sample of the metal (.8 grams) was placed in a solution of Sulfuric and Nitric acids, full strength, for a period of two days. After the two-day period had ended, the residue of what was left of the metal was filtered through a Millipore Filter, and the filter and residue were stored in a closed plastic petri dish. After a time lapse of two days, it was noticed that a form of bacteria culture was growing on the filter paper and was apparently using it as its food source. It should be noted, however, that no conclusion can be drawn with regard to the influence of the metal on the culture growth. The Chemistry Lab., being geared for metallic compositions, has no means at the present to analyze the culture to determine the culture's composition.

The metal was found not to be very magnetic in nature. The consensus of opinion among those involved with the testing is that at one time the metal was subjected to a tremendous amount of heat.

This concludes Phase One of the tests carried out by the Chemistry Lab. The metal is now in the possession of the Metallurgy Dept. The findings of the Metallurgy Dept. will constitute Phase Two of the analyzation program. Metallurgy is now in the process of evaluating the metal; they have already determined that the hardness of the metal is B-92 Rockwell. Photomicrographs taken at magnifications ranging from 100x to 800x show that the "planes" of the metal did undergo a type of slipperage such as the metal might receive if it underwent a severe impact or if the metal, being extremely hot, underwent a super cooling in a relatively short amount of time, or perhaps even a combination of the two aforesaid circumstances. The complete test results will be made known as soon as they are available. (Signed) Paul J.L. Rozich, UFORA Director.

It is interesting to note from this report that it confirms 3 of the repeated findings of earlier analyses: (1) that the metal at one time was subjected to a tremendous amount of heat; (2) that it underwent severe impact; and (3) the low magnetic nature of the metal. But perhaps the most significant finding of the report is, in fact, a non-finding, i.e., according to the major test conducted on the metal by the X-Ray Vacuum Quantometer, no traces were found of Aluminum, Calcium and Copper which normally, one would expect to find in a terrestrial alloy of Magnesium! Another intriguing feature is the strange formation of a bacteria culture on the filter paper. Could there possibly have been some element in the metal residue which stimulated this organic growth? We are not experts in this field (we are not experts period - merely sincere seekers of the truth) and possibly there is some perfectly mundane explanation for the bacteria growth in a sealed plastic dish, but while there is even a remote avenue of research open to us, we intend to follow it up even if it turns out to be a process of elimination. In the meantime, we would like to express our grateful thanks to the research workers of UFORA for their painstaking efforts and precious time so freely given in an endeavour to shed some new light on the dark mystery of the unidentified metal. We shall look forward, with eager interest, to their report on Phase Two, the findings of their Metallurgy Dept., appropriate details of which will be published at a later date.

According to an article which appeared in the Fall 1970 issue of Canadian UFO Report, Arthur Matthews, in conversation with the Editor, John Magor, stated that the scrap dealer who found the 2 chunks of metal on a shore of the St. Lawrence River, had admitted to him that he had removed them from the site of the old Quebec Bridge which collapsed in 1907 and that he towed them 20 miles to the beach near his home where he first reported to have found them. He said he'd been hesitant about telling the truth in case he was

accused of taking government property. The article suggests that the truth of this story could be checked by comparing the Ottawa Chunk with the bridge relics. If these still exist, this is certainly another avenue of research which could be followed up. However, the article goes on to throw some very logical doubts on the veracity of the story and wisely leaves the case of the mystery metal open until more acceptable answers are forthcoming.

As a matter of record, Mr. Matthews propounded his Quebec Bridge theory to our group prior to making his test on the Chunk with the Tesla Bridge, a test which, as reported earlier, left some grave doubts in the minds of some of our technical workers who witnessed it, particularly as no scientific proof was forthcoming to support it, and most of them were unable to accept that it was possible to prove that the metal mass had never been in space with a device used primarily for detecting flaws in metal railway lines! It was also noted that the volume indicator on the tape recorder linked to the Tesla Bridge showed no signs of 'life'. Last summer, one of our readers visited Mr. Matthews who, during an interview, claimed he had worked on the Quebec Bridge - and immediately recognized the Chunk as part of it! In view of the fact that Mr. Matthews had seen photos of the Chunk a long time ago, one wonders why he kept silent about its origin for so long? In this reader's report to us, he stated that Matthews had admitted to him that the Government had asked him to check the metal in the hope that we would believe him, thereby confirming a suspicion we expressed in an earlier report.

As for the Quebec Bridge theory, our group analyzed it carefully but finally dismissed it as completely untenable and certainly no scientific proof of the origin of the metal, in fact, we considered this theory to be more incredible than the possibility of the Chunk coming from Outer Space! Let us briefly analyze the facts proffered by Mr. Matthews. We are told that in 1907, the scrap dealer illegally removed 2 large pieces of metal, weighing 3000 lbs. and 800 lbs. respectively, from the collapsed bridge site. This immediately raises a number of questions: How was he able to lift this heavy material without the use of a crane which could immediately attract attention? And even if he was successful in removing it thusly, why would he go to all this trouble if the only purpose was to tow this material 20 miles and then dump it on a beach near his home? Even more intriguing, how did he manage to place the larger chunk in a delicately balanced position on a rock, and for what purpose? Having gone to all these extraordinary lengths, are we then expected to believe that the 2 chunks of metal lay undetected and untouched on the beach for 53 years? And why, after over half a century had elapsed, did he suddenly decide to pick up the 800-lb. piece and sell it as scrap metal? This aspect of the case does not tally with the story of the local beach-comber interviewed by our group in June, 1960, who said that he had covered the beach pretty thoroughly the first week of June; then came 3 days of rain when he did not work the area, but when the weather cleared, he then found the 2 metal chunks on the beach. Now if we assume that the original scrap dealer was of the average age of 30 when he took the 2 metal chunks from the Quebec Bridge in 1907, we wind up with the ludicrous picture of a doddering old man of 83 finally picking up the 800-lb. piece of metal! With all due respect to Mr. Matthews, we must make allowance for the fact that he is now a very old man and therefore, in our search for the truth, we must apply a certain amount of scientific reservation to some of his statements.

Mr. Ronald Anstee, who has played an active role in the metal research since 1965, has sent us a copy of a letter he directed to the Editor of Canadian UFO Report in which he makes some strong comments on Mr. Matthews' Quebec Bridge story, extracts of which follow: "I was present with members of the Ottawa New Sciences Club when Mr. Matthews examined(?) the metal. His statements are, when taken into consideration the way in which the metal was found plus the state of the metal, idiotic. The metal mass is very dense and heavy, and very ragged. It is in layers, having apparently gone through intense heat and very severe impact. I have been used to hard work and exercise for the past 35 years, so I know that it was not easy to break off the few metal pieces I have. The shape (of the mass) is unusual and bears no heavy scarring as one would expect to find on metal that has been cut by acetylene torches. It originally weighed about 3,000 lbs. If it was ever part of an old bridge, then how many thousands of tons did the bridge weigh? When the

chunk was being moved to a site in Ottawa, it slipped, falling on to a concrete floor and cracking it. (This incident occurred when the late Wilbert B. Smith and co-workers were placing the metal mass in a government laboratory. - Ed.) There was apparently no evidence of such a mass ever having been towed to where it was found. What methods were used to put the metal down on the boulder where it was found, without causing indentations on the rock? (There was not even rust on the metal when first found! - Ed.) Personally, taking all things into consideration, I cannot agree with Mr. Matthews' statements."

With the copy of the above letter, there was a covering letter from Mr. Anstee in which he sums up the metal situation as follows: "When I first saw the metal in 1965, the first and lasting impression I got was: (1) that it had been impacted by some extremely heavy force; (2) it had also at some time been subjected to great heat; and (3) various components, by these actions, had been forced to one central point, thus allowing for the different aspects of the overall mass, i.e., some parts can be drilled, some cannot; some parts are magnetic and some are not. In Mr. Matthews' test, he placed a device in the form of a dial on the surface of the metal from which wires passed to a tape recorder, apparently necessitating the attachment of cables to the electric power source of a car. All things give off radiations which can be picked up by the appropriate equipment, such as special cameras which can photograph the aura of the metal. It did not strike me that Mr. Matthews tests could either record the radiations or photograph the aura of the metal. If he was prepared to test the metal, he could have made sure that he was in possession of a better power source, such as a large battery. I did not see him make any physical examination of the metal or even photograph it. I had with me a 3-lb. hammer and 2 steel chisels with which I finally managed to break off a few pieces. After 20 minutes' heavy pounding, I was able to break off a larger piece which was a small part of one of the layers which had been heavily impacted on to other layers. This piece weighed $2\frac{1}{2}$ lbs. and measured 9" in length; its width varied from $\frac{1}{4}$ " to $2\frac{5}{8}$ " and its thickness from $\frac{1}{4}$ " to $13/16$ ". This was, in my estimation, a basic physical examination from which a researcher could deduce a certain amount of knowledge of the metal. The idea that such heavy material could come from a bridge is, in my opinion, preposterous, and following so closely on the other theory of the metal being slag from a Sorel foundry, it reminds one of the many cases of funny Air Force answers from sources thousands of miles away from the scene of a sighting. History is full of remarks made by so-called authorities on subjects and material they have neither seen nor examined. Such funny answers are being directed to those who have neither seen nor know anything of the metal, i.e., the majority. For those who do know something, silence is all they will receive from those who should know better - until the day finally arrives when there will be more red faces in high places than there are tomatoes in the world's largest vegetable gardens!"

Taking an open-minded view of the general metal enigma situation, we are the first to realize that numerous difficulties lie in the way of establishing definitely whether or not a metal sample is of extraterrestrial origin. The obvious reason for this and as pointed out in an earlier issue, is that there is every possibility that other planets have the same minerals as those of Planet Earth. Confirmation of this comes in an article by Dr. Allen R. Utke which appeared in the Dec. 1970 issue of that excellent journal SKYLOOK to which we give credit for the following extracts. As Dr. Utke states: "Most scientists are convinced that the same 92 natural elements found here on Earth are found everywhere in the Universe, with no new natural elements yet to be discovered. -- We would only begin to suspect extraterrestrial origin if the sample, upon extensive analysis, was found to be one of the following: 1. An uncommon element, absolutely pure or of unusually high purity. 2. A mixture of elements or an alloy with a highly unusual or previously unknown composition and/or set of properties. 3. A compound or mixture of compounds with a highly unusual or previously unknown composition and/or set of properties. 4. A material with a highly unusual or previously unknown atomic or molecular structure." Dr. Utke concedes that the only evidence which would probably convince scientists of an extraterrestrial origin is a sample whose isotopic distribution differed significantly from that of the same elements on Earth. While he suggests that matter everywhere may be isotopically alike, as a

true scientist, he admits that this has not been proven, since stellar and inter-stellar isotopic distributions are difficult to determine. This brings up a vital point which was urged by our founder, the late Wilbert B. Smith, in the early days of the discovery of the unidentified chunk of metal, i.e., the necessity for an isotopic examination of the metal, something we have been unable to obtain from any source to date and regrettably, there appears to be little hope of our doing so.

Where then do we go from here in our search for the truth of the mysterious metal? Maybe our approach to date has been along the wrong lines - in short, have we been putting the cart before the horse? If, as now seems to be established by most scientists, all natural elements have a common origin throughout the Universe, there appears little hope of proving the extra-terrestrial nature of a suspected alien metal by an analysis of the elements it contains. Therefore, perhaps the most conclusive way to determine the possible extra-terrestrial nature of such a sample - and one frequently overlooked in tests and analyses - is to concentrate not so much on what the sample contains as what it does not or should not contain in normal earth metals. The crucial question is, however, even if 100%, fool-proof evidence were established, would the Scientific Establishment be prepared to admit it, or would they produce their usual flow of phoney alibis to wriggle out of acknowledging the existence of extraterrestrial material? A typical case in point were the UFO fragments found in 1957 on a beach in the Ubatuba region of Brazil. After a long history of various international tests, in 1968 the FBI Laboratories in Washington subjected one of the fragments to neutron activation analysis when the sample was found to be 99.9% pure magnesium. The remaining impurities were minute quantities of strontium, zinc, barium, manganese and chromium. Again, it was the non-contents of the material that were of vital importance, but despite the fact that no traces were found of aluminum or calcium, elements normally found in terrestrial magnesium, most scientists refused to be convinced of the extraterrestrial nature of these UFO fragments.

Arthur Bray was one of the first to latch on to the importance of non-contents of metal analyses of suspected extraterrestrial material and at the time that Dr. P. Millman addressed our group in April, 1969, Arthur brought up this very point with him, but with little apparent response from this internationally-acclaimed scientist. However, despite the odds against us, we in private UFO research, should press on regardless and with sincere prayer that in the final analysis (pun unintentional but appropriate!), the TRUTH will prevail! Who knows, perhaps with a greater concentration on the non-contents of suspected alien material, we may yet be able to prove publicly the extraterrestrial nature of certain metal samples? From knowledge of the personal experiences of the late Wilbert B. Smith, of one thing we are sure - those government scientists engaged on UFO research, who work so mysteriously behind the "silence curtain", have been well aware of the existence of extraterrestrial material for a long time now!

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THE MYSTERIOUS CHUNK OF HARDWARE AT OTTAWA

On the outside property of the Headquarters of the Ottawa New Sciences Club there lies a large piece of metal - an unidentified object which has so far baffled all attempts at positive identification and over which an aura of mystery hangs as to its exact composition, purpose, origin and most of all, the unusual circumstances surrounding the finding of this large chunk of hardware in the St. Lawrence River of Quebec. This piece of metal measures about 4 ft. by 6 ft. and is roughly oval in shape, somewhat like an inverted mushroom, i.e., flat on top and roughly hemispherical on the underside. A plug or post about 9" in diameter, at 90° to the flat surface, penetrates the centre of the mass and extends through top and bottom surfaces. A smaller protuberance, which may be the remains of a 2½" pipe, appears out of the flat surface near the plug. The weight is estimated at about 3,000 pounds. The whole is made up of layers of material which evidently have been subjected to very high temperatures and pressure. The material is ferrous, extremely hard, and resistant to all attempts to cut or dismantle it. It is faintly magnetic until melted when it seems to acquire approximately the magnetic permeability of mild steel.

As a couple of articles on this mystery metal have recently appeared in French language newspapers containing a number of inaccuracies with regard to the facts of the case as we know them in Ottawa, we propose to give our readers a brief account of the history of the metal as far as we know it.

According to an early account which appeared in a French language newspaper in Quebec - on June 12, 1960, between 3 and 4 a.m., EDT, a sonic boom rocked the area around Quebec City. At about the same time, a fiery object fell out of the sky splitting at about one to two thousand feet altitude, into two pieces, one somewhat larger than the other. Both fell into the St. Lawrence River, near Les Ecureils, about 20 miles up river from Quebec City. The smaller piece was quite close to the shore and visible at low tide; the other lay close to the shipping lane and was completely submerged.

It should, however, be pointed out that when, shortly afterwards, a group of Club members carried out an investigation at the actual location, they were unable to find anyone in the Les Ecureils area who had actually heard or seen the metal fall - strange, in such a small town. So the manner in which the metal arrived at the scene still remains a mystery.

The Area. At Les Ecureils, the river bank drops sharply to a relatively flat shale bed which extends out for nearly a quarter of a mile to the deep water shipping channel. The channel is separated from the shale area by a jumble of large boulders. The river is tidal so that the area of the find varies from dry to a maximum depth of water of about 1½ feet.

The Find. A local resident, who supplements his income by beachcombing, covered the area pretty thoroughly the first day or two of June. Then came three days of rain during which he did not work the area. When the weather cleared, he found the two pieces of metal on the shale bed.

Disposition of the Metal. The finder, unable to handle the larger chunk, loaded the small 800-lb. piece and sold it for one cent a pound to a scrap metal dealer in Quebec City where it was erroneously classified as non-ferrous metal. The large magnetic crane used for handling the scrap, would not lift the metal due to its low magnetic permeability, so it was pushed into a pile of non-ferrous scrap and eventually shipped to Japan. As for the larger piece of metal, rumour of the find reached the Canadian Arsenal's Research and Development Establishment (CARDE) in the area, who, thinking it might have been part of a space capsule, picked it up for investigation. On completion of their investigations, CARDE eventually handed the metal over to a Club member who, at great difficulty, trailered the heavy object to Ottawa where it is now in the custody of the Club.

The Findings. After analysis, CARDE reached the following conclusions: "The X-ray diffraction analysis indicated that the unidentified object consisted of a metallic face-centred cubic compound, with a unit-cell dimension agreeing with those of 1) austenitic steel, and 2) meteoric iron. The semi-quantitative spectro-graphic analysis showed, however, that there was insufficient nickel present for the material to be of meteoric origin. The amount of manganese detected in the spectro-graphic analysis suggests that the metallic material is best described as high-manganese austenitic steel. This is consistent with the very weak ferro-magnetic nature of the metal. The iron oxide and the hydrated iron oxides on the surface are normal results of the exposure of steel to the atmosphere. The amounts of quartz and calcite detected by X-ray diffraction are very small, and are common extraneous materials. The low nickel and high manganese content are not consistent with a meteoric origin, whereas they are consistent with common high-tensile steels. The object is therefore considered to be of terrestrial origin."

Another report states in part: "The metal object proved to be a mass of high strength metal which had fallen, or had been dropped, while in a plastic state, and had splattered like a ball of mud. It was 6 ft. in diameter and 2 ft. thick at the centre. At the centre of the body, there was an outline of a tube about 10 inches in diameter which protruded from the mass about 6 inches. A small electronic potting can was imbedded near one of the outer edges. By scratching away the potting plastic, it was possible to identify an electronic component which appeared to be a transistor. There was also the imprint of another electronic can which appeared to have been removed by curio seekers. It is not considered that the object

fell in the location where it was found, because there was no crater or splattered material in the vicinity. The tidal flats at this point are solid rock. An analysis by CARDE revealed that the metal is an alloy with high manganese content. CARDE personnel who are familiar with foundry operations, consider it to be a normal product of a foundry consisting of slag with semi-molten scrap imbedded. Their investigation did not reveal any electronic components."

Despite the findings of CARDE, an element of doubt exists as to whether these are completely accurate. Although they considered the object to be of terrestrial origin, laboratory experiments on the metal carried out by the late Wilbert B. Smith and co-workers, resulted in a number of unusual reactions not consistent with the normal behaviour of terrestrial metal. This was most evident when a small piece of the metal was heated with an acetylene torch which caused it to blossom into a miniature white cloud with extremely bright sparks in it - a sort of A-bomb in miniature. WBS concluded that the magnesium went exothermic, reduced the ferrite in the spinnal crystal structure, formed the cloud and left the iron free to burn with O_2 in the air. He warned that anyone attempting to heat a larger chunk of the metal might very well fry himself! He also considered that the intense heating should have burned the object worse than it did and he therefore reached the conclusion that it could not have been a blast furnace product. Further experiments revealed that some parts of the metal could not stand too much heat, thus limiting the possibilities as to why such a manufactured item came to grief. In testing the metal with the acetylene torch, it was noted that the resulting sphere, with its intensely brilliant shower of sparks, burned until nothing remained - no residue or slag, as is common with earth metals.

CARDE suggested that the metal may have been slag from a foundry brought to the area via an ice floe. The facts of the case, however, do not bear this out. The nearest mills are many miles from Les Ecureils - and it was the month of June. The material is not a common foundry product, and even if it had been, one wonders why the foundry would waste 3,000 pounds of metal!

More Mysteries. How the metal arrived at Les Ecureils remains the biggest mystery of all. The maximum depth of water at high tide and the closely-spaced boulders along the shipping channel would seem to rule out any possibility of arrival by boat or raft. Had it fallen from the sky, the noise would have been earth-shaking. Even a small meteorite sounds like a rushing freight train.

A further mystery, indicating the possibility of exposure of the metal in outer space, is that the outer surface, under powerful magnification, shows minute inclusions which well may be micro-meteorites picked up during a long sojourn in space. The Club has in its possession a series of photographs of the outer surface of the metal, taken with the aid of micro-photography, in which these inclusions can be observed quite clearly. The density of these particles is about 30 per square centimeter. Dr. Peter Millman of the Canadian National Research Council, estimated that micro-meteorites of this size would occur through a sq. cm. section at about 10^{-6} second, so it would take about a year to accumulate such a density.

Analyses. Several chemical analyses of the metal have been made by the Club. These vary, indicating that the mass is not homogeneous. To date, the Club has been unable to find any organization with the proper facilities, willing to carry out a mass spectrophotographic analysis to determine the number of isotopes in the various elements contained in the metal. If this could be done, it would establish whether or not the material is of terrestrial origin, although, of course, there is always the possibility that other planets may have the same minerals as Planet Earth. And even if it were proved to be of terrestrial origin, there still remains the intriguing mystery of how it arrived on the beach!

Reprinted from Spring 1966 issue of
"Topside".