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ESPECIAL REPORT: PHYSICAL EVIDENCE PROVING UAOs TO BE CRAFT FROM OUTER SPACE

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By Dr. Olavo Fontes

The absence of physical evidence--such as crashed saucers--has been taken as the best evidence against the existence of UAOs. In fact, it is difficult to recognize the reality of a flying machine so far advanced as to have reduced the probability of mechanical failure to near zero. Major Edward J. Ruppelt, USAFR, in his excellent book, "The Report on Unidentified Flying Objects," stated that the USAF had never picked up any "hardware"--any whole saucers, pieces or parts--that couldn't be readily identified as being something very earthly. I believe him. But I also believe that he was aware of the possibility of a saucer crash, at any time--if saucers existed, of course--giving to UAO-investigators something more concrete than the circumstantial evidence they had before.

It seems to have happened, at last, near the Brazilian coast. I offer the information in this report to him and to his friends in the USAF who didn't believe that "it can't be."

Anyone who can learn anything is constantly reminded that he does not know everything. If he is, in fact, learning--not assuming the attitude of one already knowing, or pretending that the unfamiliar is not worth knowing--he is not likely to be thrown into a panic if his mind feels the touch of the unknown. Because he knows the unknown is here. And it is not something to be feared if it cannot be avoided; or something to ward off, explain away, exclude, reject, distrust or even destroy. He does not reject knowledge and he is not fearful of it, not fearful of moving beyond it--but at ease with its problems and possibilities.

This report was written to people of that kind all-over the world. It concerns what appears to be the final proof--physical proof--of the existence and extraterrestrial origin of UAOs.

CASE REPORT

On September 14, 1957, Mr. Ibrahim Sued, a social columnist who lives in Rio de Janeiro, reported a strange story that startled the readers of the newspaper "O GLOBO," in which his column is published. Under the heading, "A fragment from a Flying Disk," he printed the following (transcribed verbatim):

"We received This letter:

" Dear Mr. Ibrahim Sued. As a faithful reader of your column and your admirer, I wish to give you something of the highest interest to a newspaperman, about the flying saucers. If you believe that they are real, of course. I also didn't believe anything said or published about them. But just a few days ago I had to change my mind. I was fishing together with some friends at a place near the town of Ubatuba, São Paulo, when I saw a flying disk. It approached the beach at unbelievable speed, seeming imminent an accident--i.e., a crash into the sea. At the last moment, however, when it was almost striking the waters, it made a sharp turn upwards and climbed up rapidly on a fantastic manoeuver. We followed the spectacle with our eyes, startled, when we saw the disk explode in flames. It disintegrated into thousands of fiery fragments, which fell sparkling with magnificent brightness. They looked like fireworks, in spite of the time of the accident--at noon, i.e., at midday. Most of these fragments, almost all, fell in 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 as light as paper. I enclosed herewith a small sample of it. I don't know any one that could be trusted to whom I might send it for analysis. I never read about a flying saucer having been found, or about fragments or parts of a saucer that had been picked up.--Unless it had been done by military authorities and the whole thing kept as a top-secret subject. I am certain that 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."

" From the admirer (his signature was not legible), together with the letter above, I received fragments of a strange metal...."

Mr. Ibrahim Sued had never written about saucers before. This unusual story stirred up my curiosity. Obviously, the whole thing could be a joke or a well-planned hoax. At first I tried to think that way and dismiss the matter, but soon I knew it was no use. I had to contact Mr. Sued and take a look at the material, to find out the answer I was looking for. So I phoned him and asked for a meeting to talk personally with him about the case. He agreed. I went to his apartment fourx hours later. There, on the table, was the sample sent by the unknown correspondent....

A dull-grey, solid substance that seemed to be a metal of some sort. Three little pieces. They were not smooth or polished on the outside, but rough and irregular, and appeared to be pieces or fragments disintegrated from a larger metallic mass; one piece even showed, at one face, a longitudinal crack running through almost two-thirds of it, plus minute longitudinal fissures, almost microscopic, at different places--as if that piece had been disrupted under the action of some force. Besides, on the surface of all samples, there were whitish scattered areas produced by the deposition of a thin layer of a powdered substan-

ce. The fine, dry powder was adherent but could be easily displaced by a finger-nail. It presented some similarity with the whitish powdered cinders on a chunk of burned charcoal--as if the metallic pieces had been scorched by some fire, or injured by too much heat or radiation.

I picked up one of the fragments. Mr. Sued, who was watching me, said that at first sight I could think the material to be lead--because of the grey color. But I would see that it couldn't be lead, a heavy metal, if I felt the wheight of that sample in my hands. He was right. The material was light, even lighter than aluminum--almost as light as paper. Amazed, I told him that I had some friends with scientific background very much interested in the problem of the saucers. They would like very much to analyse a bit of that substance. He answered he knew notaing about the question but didn't believe in the existence of such things. As a result, he was not curious about the material. I could take it, if I wished, and send it to my friends. Of course, if something unusual was found in the analysis, he would appreciate knowing about it. It was a generous attitude. I thanked him for it, promised to keep him informed and get the material.

PRELIMINARY EVALUATION

On examining the data reported on the saucer's crash, I concluded that they offered insufficient solid information for evaluation. However, a few points attracted my interest:

1. The witness seemed to be very sure about the accuracy of his observation. In his description of the thing in the sky he called it a "flying disk". No more details. This is a good point on his side. In my experience of psychology applied to the investigation of UAO's sightings, I learned that the reliability of saucer reports generally varies inversely with the detail that the observer reports. The hoaxes are almost always marked by an accurate and precise description of detail, in such a way that it is obvious that the witness is drawing on his imagination. The observer in the case, however, didn't give a vivid description of the "saucer" or of its crash. His report is simple, clear and concise as it would occur in a true case.

2. He said that he was together with some friends. This may give more credence to his report, if proved to be true. One person can have a delusion or hallucinations, but they won't be seen by a friend.

3. He was not apparently a saucer cultist. He said that he never had heard about saucer landings or crashes. A cultist would comment about those possibilities as "verified

facts", hidden by the authorities as a part of their great conspiracy to distort the truth about the saucers. A cultist would strip his report of any information that could point to a natural explanation. A cultist would make "correct" estimations of height, speed, size and distance and would treat them as accurate data; he would make an enthusiastic discourse about the value of the physical evidence he was sending to Mr. Sued. Because he did like nothing of that, the person who wrote the letter cannot be classified as a saucer cultist, at least in this preliminary evaluation of his report.

4. He could be a hoaxer, but a poor one. A good hoaxer would have presented his case in a press-conference to get a lot of publicity. He would never start with a timid letter to the wrong person, a social columnist who didn't believe in saucers. Most of all, he would never send the "saucer fragments" together with the first letter, before knowing if Mr. Sued was really interested in his tale (he was not).

5. If he thought he saw a saucer he must have seen something. To get a reaction from one of the senses there must be a stimulus. However, no known optical or natural atmospheric phenomenon fits the facts. No natural object or man-made machine, traveling at terrific speed, has ever been seen to make a sudden upward turn. No human being would have risked being crushed by the tremendous "G" load brought to bear on the craft during its abrupt vertical veer, just before the explosion reported by the witness.

6. He said the unknown craft was a "flying disk". In Brazil the term is used to describe only disk-shaped UAOs. Unconventional objects other than disks have different denominations: flying cigars, fireballs, flying spheres or balls, etc. This is a point to be stressed in this case, chiefly because no detail about the craft was reported. In other countries the term would be misleading because it is applied to UAOs of every conceivable shape, to anything in the sky that cannot be identified as a common, everyday object. This is not so in my country and we can be sure that the observer sighted obviously a disk-shaped UAO, if he told the truth.

7. He was not aware, apparently, that the first man to lock down physical proof showing that UAOs come from outer space would go down in history with a big name. Only a clever hoaxer (doing it on purpose), or a man who knew nothing about the UAO-problem would act like this.

I could stop at this point and start an investigation to find out more about the sighting. In an ordinary case I would send someone up to Ubatuba immediately in the hope of getting more data from the witnesses. But there was a better approach to evaluate this unusual case. There was something that, if properly evaluated, could give a definite

answer to the sighting immediately. That something was the "hardware" picked up by Mr. Sued's correspondent--the "fragments" of the saucer that was blown to bits right before his eyes. The analysis of such a material could show one of the following results:

1). It could readily identify it as something very earthly. For example, iron, aluminum or even ordinary lead, solder, any well-known metallic alloy, etc. In this case the story obviously would be discarded as a fairy tale or hoax.

2). It could identify it as being a material existing on our planet, but hard to be obtained or processed. The sample, here, could still come from the UAO but a full investigation of the witnesses would have to be made, in order to evaluate the reliability of their information--before any conclusion could be reached.

3). As last possibility, it could identify it as an unknown substance; or as an unknown alloy; or as a metal with characteristics and properties far beyond the possibilities of processing methods and technologies of terrestrial Metallurgy. The single analysis of the material would be enough, in this particular case, to prove the whole story definitely true. Further investigation of the report would be needed only to complete the information about the incident.

Such a result would be also the final proof--physical proof--showing that UAOs are real, and that they are craft from outer space.

The peculiar appearance of the metallic chunks indicated that they could well be "fragments" produced through the explosion of a larger metallic mass, as reported by the observer; and that they had been scorched or burned by some kind of fire, heat or radiation. Besides, the material was very light. I had noticed these peculiarities since the beginning and was baffled. I confess that I kept the samples for seven days before making the decision about my course of action. At last, I decided to send the material to a laboratory to be analysed.

THE ANALYSES: MATERIALS AND METHODS

The metallic chunks from the "wreckage" of the UAO were turned over to a Government laboratory, the Mineral Production Laboratory, a division of the National Department of Mineral Production. This department is a branch of a Government institution, a federal organization--the Agriculture Ministry of the US of Brazil. The sample was registered as being of "unknown origin", and delivered personally to Dr. Pfeigell, the chief-chemist. I didn't know him and was introduced by a friend. I hoped that this famous German chemist would make the analysis, but he was doing at the time experimental work on organic chemistry and researches of a different kind (on plastics) and couldn't take

charge. He called for Dr. David Goldschmim, one of his assistants, who carefully studied the samples and said that they could be meteorite's fragments. But Dr. Pfeigell didn't agree:

"They are too light to be fragments of a meteorite. They seem to be made of a metal, a lightweight metal. But it is not aluminum. I am going to make a test."

A small bit of the material was placed in a test tube. A few drops of phosphomolybdic acid were added, plus a few drops of dilute hydrochloric acid. It was a screening test for metals. If the material was metallic a blue color would appear in the test tube (phosphomolybdic acid is easily reduced, when in the presence of a reducing agent, to produce the blue-colored mixture of colloidal reduced oxides of molybdenium. At first there was no change but, when the tube was heated, bubbles appeared on the surface of the sample and a blue color was observed. Thus, the material (or part of it) was, in fact, metallic.

It was decided that a Spectrographic Analysis should be done for the identification of the unknown material. It was a wise decision. The Spectrographic method is extremely sensitive and makes it possible to determine the composition of a piece of metal no larger than the head of a pin. By its aid, minute traces of elements can be detected in large amounts of other elements--traces so small that they couldn't possibly be detected by any other means. ~~All metals~~ each one as well as gases and a few non-metals gives a spectrum which is uniquely its own, whether it consists of two lines (sodium), or thousands of lines (iron), and whether the element is alone or in combination. Each element, when excited in the proper conditions, gives its spectrum, and all compounds are resolved into their components.

One of the "disk's fragments" was divided in ~~several~~ five pieces. One of them was sent, the same day, to the Spectrographic Section of the Mineral Production Lab. ~~The other were~~ Three were given to me again, to be kept for other analyses (if necessary). The two remaining metallic fragments were also kept, and later photographed. The photos are shown below, in Fig. 4.A. and Fig. 4.B.:

-- Fig. 4.A. -- --Fig. 4.B. --

The large piece in the photos shows the longitudinal crack and fissures already described. The smaller has a peculiar curved cross-section, suggesting that it belonged to ax spherical object, a curved shell, or a dome-shaped structure.

I was curious about the results to be found by the analysis. I was aware that the presence or absence in the unknown material of seventy of the chemical elements would be revealed by the Spectrograph; and that no element of this group could be missed if it constituted as much as the one-millionth part of the whole.

It was decided that, if necessary, the material would be also studied by other methods. The other methods suggested were the following: 1). Quantitative spectrographic analysis;

2). X-ray diffraction analysis; and,3). mass spectrograph analysis.

THE ANALYSES: RESULTS

I - SPECTROGRAPHIC ANALYSIS:

It was made with a large Hilger Spectrograph used in the Spectroscopic Section of the Mineral Production Laboratory when ~~more~~ more precise and reliable results are desired. The official analysis was made,on September 24, by the chief-chemist of the section, Dr. Luisa Maria A. Barbosa. A photocopy of the spectrographic analysis' report, received a few days latter, is shown in Fig. 1.A.

- Fig. 1.A. -

For better understanding of its terms, a translation of this report is shown in Fig. 1.B.

- Fig. 1.B. -

I would like to stress that I expected a more detailed description of the results found in the analysis. Not satisfied, I went to the laboratory on September 30,to meet Dr. Luisa Maria A. Barbosa and ask for an explanation about the report. We talked for almost an hour. I tried to impress upon her the necessity of having a complete report on all technical data concerning the spectrum lines recorded in the photographic plate, instead of a single conclusion as in her report. She didn't like it. She said I had no authority to appraise the merit of her work; if I was a chemist I would be satisfied, but I was not. So, my opinion was not important, etc, etc. I tried all arguments to change her mind, but she stubbornly refuted my reasons and refused to consider my request. At the end, I asked some questions about the results obtained in the analysis. A summary of questions and answers is transcribed below:

Q. Your analysis showed the presence of magnesium of a high degree of purity, and absence of any other metallic element. Right?

A. Yes. I found all common and uncommon spectrum lines of the element magnesium. There was no other metallic element in the sample, not even the so-called "trace elements" usually detected in the metallic samples.

Q. Your report suggests that the metal in the sample was absolutely pure, with a percentage of 100 per cent. But you did not stated it. Why?

A. Because of the fact that different compounds or states of combination of the same element are not distinguishable by spectrographic analysis. The method has its limitations and most of the non-metallic elements are not detected by it. The exceptions are very few. Thus, in this case, it could be a mixture of the element found with any of its compounds, or chemical combination with any of those non-metallic elements (a salt, for example).

Q. I understand. Now, I would appreciate very much to see the spectrographic plate.

A. Of course. Here you have it (and showed me the film). You can see five spectra on it. The spectrum corresponding to the material analysed is the first one, from above to below. It shows a number of spectrum lines, but all these lines are from the spectrum of magnesium. The other four spectra were made just for comparison purposes. The third in the plate also correspond to magnesium, to a chempur magnesium salt (CO_3Mg). The remaining (second, fourth and fifth) are spectra of iron (Fe).

And here ended our meeting. Later, I requested a photocopy of that spectrographic plate. It is shown in Fig. 1.C., the following:

- Fig. 1.C. -

In order to overcome any lack of basic data, and to obtain a better evaluation of the pattern found, I decided to request a second spectrographic analysis of the material. It was made on October 24, 1957, in the same Spectrograph. The chemist who took the charge, Mr. Elson Teixeira, was an expert in Spectrography. For fifteen years he had worked in the Mineral Production Laboratory, but he left the job a few years ago to become a business man. However, he still had license to use the lab to do anything he wanted. He agreed to make a particular analysis of the material--instead of doing a second report on the analysis by Dr. Barbosa (for ethical reasons). Mr. Teixeira's report, transcribed verbatim (and translated), is shown in Fig. 2.A.

- Fig. 2.A. -

He had planned also a Quantitative Spectrographic analysis, to determine the concentration of any impurity detected in the sample. But the unexpected absence of impurities of any kind made this analysis obviously unnecessary.

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There was still a third spectrographic analysis of the material. Someone informed the Brazilian Army about the case and I was phoned by Major Roberto Caminha, who requested a sample of the material. He received it on November 4. The analysis was done at the I.T.M. (Military Institute of Technology), but the report is not yet available. They got also a written report containing all information I had about the incident. I am informed that a full investigation will be ordered by the Brazilian Army at any time.

II - X-RAY DIFFRACTION ANALYSIS:

This X-ray method of identification was obviously indicated to complete the results obtained through the spectrographic analysis. The important advantages of the procedure are that only small quantities of the material are required (a few mg), and that different compounds or states of combination of the same elements are distinguishable from each other, since they possess different crystal structures. It is widely used for the identification of alloy phases. If more than one variety of crystal is present in any specimen, each will produce its spectrum independently, and the pattern will consist of superimposed spectra with relative intensities depending on the relative amounts of the phases. Thus, the constitution of inorganic and organic systems, minerals, and alloy systems can be determined with accuracy through X-Ray Crystallography. Besides, X-rays also are applied for chemical analysis through the use of spectrometers that record the characteristic X-ray emission lines or absorption edges of the sample to be examined. Favorable combinations of elements permit extreme sensitivity in the detection of small percentages of an element in a compound or mixture (independent of the state of chemical combination), and also permit fair precision in quantitative analysis§.

It is evident that the extremely precise results of X-ray diffraction analysis together with the advantages specified above make it an extremely sensitive method to determine the composition and structure of metals. So, in order to complete the data obtained through the spectrographic analysis of the "disk's fragments," and to have a better evaluation concerning the state of purity of the magnesium in the samples, I decided to request an analysis by this technique.

A small sample of the material was sent to the Laboratory of Crystallography of the "Geology and Mineralogy Division of the National Department of Mineral Production." The director of this research institution, Dr. Elysiario Tavora Filho is a well-known scientist, famous in my country because of his pioneer works in Crystallography since 1949. He is the Brazilian top-expert in the field. He also has the position of Professor of Mineralogy at The National Chemistry School. He is responsible for the results that will be presented here. I believe that his work could not be more perfect; it is complete in every detail and flawless.

A preliminary identification of the unknown material by X-ray spectrometry showed that it was really magnesium; and that the metal seemed to be absolutely pure, with a percentage of 100 per cent. Amazed by this truly incredible result, Prof. Tavora sent one of

§ - G. von Hevesy: Chemical Analysis by X-Rays and Its Application. McGraw-Hill Book Co., New York, 1932.

his assistants, Dr. Augusto Batista, to the Mineral Production Laboratory. Dr. Batista's mission was to request a careful re-examination of the spectrographic plate. When I was informed about the fact, a few days later, I failed to recognise the significance of this event. I learned later that Prof. Tavora had realized, at that time, the full implication of the reported absence of impurities in the sample: that magnesium was more pure than the ASTM standard of purity (ASTM 4-0770) used in the determination of the diffraction pattern of this element. It was an astounding discovery, (one) that couldn't be believed. But he had no choice; as a true scientist, he couldn't discard the hard, cold facts of the scientific evidence. So, he decided to make a complete study of the powder diffraction pattern of the material, by the Powder method, to settle the question.

A powder camera of the Debye-Scherrer-Hull was employed. The diffraction pattern of a fine-grained polycrystalline specimen of the material was registered on a photographic film (of the cylindrical type). From the position of the lines on the film (the so-called "Debye rings"), the spacing d of the correspondent atomic planes was obtained. It was seen that all lines (or arcs) on the film corresponded to magnesium, with the exception of six very faint ones. Was it the impurity (s) so long desired? A second diffraction pattern was obtained from the dry, white powder which formed a thin, adherent layer on the surface of the material. This powder was identified as magnesium hydroxide ($Mg(OH)_2$) plus magnesium(Mg). Magnesium hydroxide was the impurity in question. It was not, evidently, in the original metal, appearing as an effect of the explosion and fall of the burning magnesium fragments through the atmosphere, and into the sea.

The diffraction patterns of magnesium and magnesium hydroxide are shown, side by side, in Fig. 3.A. They are photocopies of the original photographic films obtained by Prof. Tavora.

- Fig. 3.A -

From the X-ray pictures supplemented by other data, Dr. Tavora determined space lattices, the spacing d of the correspondent atomic planes (interplanar distance), and the values of θ. The relative intensity of each line or arc was also measured. The patterns obtained are shown in Fig. 3.B., which is a photocopy of the original X-ray diffraction analyses' report.

- Fig. 3.B. -

Dr. Tavora also promissed a written statement about the findings reported above. So far I have not received it.

For those who possess the technical background needed for the interpretation of the technical data recorded on the photocopy reproduced above, a translation of the analyses'

report was made. It is shown in Fig. 3.C.

- Fig. 3.C. -

III - RADIATION TESTS:

The "disk's fragments" were tested with radiation-detection instruments. A Geiger counter and an Atomic Scaler were used. But nothing out of the ordinary ocurred during these tests. No abnormal amount of radiation was found.

DISCUSSION

Ever since I had become interested in UAO reports, the comment of those who had been requested to look them over and give a sincere opinion was that I lacked the type of data "you could hold in your hands." In fact, even in the best cases, the investigator had to rely upon what someone had seen. It is evident that if we had even one piece of information that was substantiated by some kind of physical evidence or recorded proof that one could sit down and study--then we would be qualified to give a final yes or no answer to the UAO problem.

The "metallic" chunks picked up from the "wreckage of a flying disk," at a beach near Ubatuba, São Paulo, were identified as being really a metal--a lightweight metal. It was not only magnesium (Mg), but chemically pure magnesium--of such a fantastic purity that even to see it symbolised on paper is unbelievable. Even the infinitesimal quantities of "trace" elements expected to be detected by the spectrographic analysis (traces so small that they couldn't possibly be detected by any other means), were not found. Thus, the metal was absolutely pure--with a percentage of 100 per cent. On the other hand, the X-ray method identified the unknown material as metallic magnesium, showing that each metallic crystal in the sample was a pure magnesium crystal, so perfect that no defects could be detected in its lattice structure. Again, no impurity was found introducing irregularities in the crystal lattice. The method permits extreme precision in the detection of very small amounts of impurities, because the presence of any interstitial atoms changes the regularity of the crystal lattice, thus causing crystal imperfections. Not being the case, the X-ray diffraction analysis confirmed the results of the spectrographic study: it was absolutely pure magnesium (100.00 per cent pure); and if there was any other substance in the "disk's fragments, it would be present in such an infinitesimal amount as to be beyond the reach of any known method of chemical analysis.

Now we really know very little about metals that are completely free of impurities and imperfections, simply because they are never found in nature and, in most cases, cannot

be prepared in the laboratory. It is not too hard to refine a metal to 99.99-per cent purity, which means there is something else beside the metal present to the extent of one part in 10.000---but once we get beyond this point the going gets rough. For every 9 we stick on behind the decimal point after the first two 9's, the cost increases ten-fold, sometimes 100-fold. The reason for this is that involved, delicate and time-consuming crystallization operations are required, so that the final product becomes more precious than gold. To study the properties of super-pure metals the first problem is to secure them. As a matter of fact, the task seemed hopeless for any metal until five years ago, when the American metallurgist Walter Pfann invented the zone-refining process---which promises to be one of the outstanding developments in the story of metallurgists' efforts to produce super-pure metals. With it, it has been possible to produce germanium and molybdenum (plus iron and titanium, according to some sources of information) of almost absolute purity. However, even with this process, everything has to be done piecemeal: metals cannot be purified continuously. This is the one great drawback to really large-scale production of pure metals. But this drawback seems now to have been demolished by an new development announced by Dr. Pfann two years ago. His new invention, based on the zone refining method, which is called "continuous multi-stage zone refining," will make it possible to get pure metal in a continuous flow.

Such is the situation concerning the last developments in the field of super-pure metals. A few ~~ones~~ can already be refined to approach absolute purity. But the problem still remains unsolved for a number of other metals, because of tecanical difficulties not yet eliminated ~~demolished~~. Magnesium is included in this last group. In other words, to produce magnesium of absolute purity would be an impossible task---outside of the range of present-day technological developments. We can come close to it, but getting rid of the last bit of impurity is truly impossible, even in the laboratory. We are going to discuss the matter with more detail to get indirect and direct support of this postulation.

Magnesium occurrs abundantly, but always in combination. The production of metallic magnesium requires special extraction and refining methods. The most widely used is the process of Electrolytic reduction of magnesium chloride derived from sea water, natural brines, potash waste liquors, dolomite and magnesite. Thermal reduction processes are also available. They are of two types, one using carbon (the Hansgirg process), the other using ferrosilicon (the Pidgeon process), for the reduction of magnesium oxide derived from magnesite, dolomite or sea water.

Refined commercial magnesium of a purity of 99.80% Mg (Pure magnesium. ASTM number:B 92-45) can be produced by any of these methods, being available in the form of ingots, powder, ribbon, wire, and extruded and rolled strip. Impurities such as iron, nickel and copper have definite tolerance limits. The quantity and state of these impurities determines the resistence of the metal to corrosion. Some elements are not harmful in large proportions, but others are detrimental even when present in minute amounts. Composition limits for commercially pure magnesium (ASTM B 92-45 for ingot and stick)§ :

" Pure magnesium sheet, wire, extrusions, ribbon, and ingot and stick for remelting: 99.80% Mg min; impurities (max), 0.02% Cu, 0.001% Ni, 0.20% total of Al, Cu, Fe, Mn, Ni and Si. Powder, Grade C: 96% Mg min; impurities (max), metallic Fe 0.05%, insoluble residue 0.25%; Si 0.10%, grease and oil 0.020%, alloyed iron and aluminum as oxides 0.40%"

Calcium is usually present in very small quantities, chiefly in solid solution; if present in amounts greater than approximately 0.1%, calcium occurs as Mg_2Ca. It is not harmful and, in some magnesium alloys (M1 and AZ31X), it is added to improve certain characteristics, as the grain size of the ingot,rolling properties and ductility. Excessive amounts of calcium, however, are considered detrimental to welding characteristics in some alloys.

The presence of even a few hundredths per cent of manganese greatly increases the tolerance limit for iron (which is 0.017% for pure magnesium), and also for nickel. Manganese, zinc and aluminum are the chief alloying components of magnesium alloys; aluminum can be added to increase strength and hardness, while the others are added to improve resistance to corrosion.

Silicon is the impurity usually picked up in ordinary foundry operations and occurs generally as Mg_2Si. If present in amounts of 0.5% or more, it changes the regularity in the crystal lattice causing defects in the magnesium crystals.

At this point, it is evident that the quantities of these impurities which are found in commercially pure magnesium vary according to the sources of production and methods employed. In any case, however, they are always present--even in the composition of the purest commercial magnesium available to the consumer. This fact clearly demonstrates that the metal in the samples analysed was not commercially pure magnesium.

Pure magnesium (99.80%) can be still refined to a higher degree of purity (99.9%). But complex and time-consuming operations are required so that the final product becomes more costly than gold. Besides, it cannot be prepared in scale large enough to be of

§ Townsend, R. A.: "Properties of Magnesium and Magnesium Alloys." Metals Handbook,

industrial application. It is made only for special uses. For example, to be employed as " standard" of purity, or for research purposes on the understanding of the fundamental properties of metals. However, the purest magnesium ever produced in this earth still has impurities that can be identified in the spectrographic analysis.

The ASTM standard of purity for magnesium (ASTM 4-0770)§ shows, in the spectrographic analysis, the following impurities:

" Ca < 0.1%; and traces of Al, Cu, Fe and Si."

It is the most pure magnesium that can be produced by present-day processing methods and technologies of terrestrial metallurgy.

In other words, the magnesium in the samples analysed, which was absolutely pure, represents something outside the range of present-day technological developments of our science. On the basis of this study, it is highly probable that the metallic chunks picked up in a beach near Ubatuba, São Paulo, are really "fragments" of a flying disk. In this particular case, the analyses' reports seem to be enough to prove the whole story as definitely true. Further investigation of the incident will be needed, of course. But only to complete the information about it, and to get more samples of the material.

This is indeed an extremely interesting and truly incredible conclusion. But there is no other alternative. As staggering as the implications may be, to my mind this is the only acceptable explanation.

So, the UAOs are interplanetary spacecraft. We have the final proof--physical evidence--to prove it. This evidence shows that they (are) unconventional craft controlled and operated by intelligences of some sort; that some of them, at least (the flying disks), are made with super-pure magnesium (100.0% Mg); and that they come evidently from outer space, because the production of absolutely pure magnesium is beyond the possibilities of of present-day technologies of man.

The only remaining question refers to the density of this magnesium in the "saucer fragments." It was found to be 1.866. It is higher than the density of terrestrial magnesium (1.741). How to explain the difference? One possible cause would be the presence of a heavier element in the same material; but it can be discarded because the analyses proved the material to be superpure magnesium. Or, it could be explained by a hitherto-unknown close-packed modification of ordinary magnesium; but it is not the case, because X-ray diffraction identified the ordinary crystal structure of this metal (close-packed hexagonal). The only explanation of the density then will have to (be) sought in a heavier isotope of magnesium (not occurring on earth), or in a different distribution of the three stable isotopes of the metal found in our planet.

§ Ref. Swanson and Tatge, JC Fell Reports, NBS 1951.

As a matter of fact, most of the elements are made up of two or more isotopes. Elements are the ultimate constituents beyond which matter cannot be analysed by chemical processes; isotopes are the ultimate particles into which elements can be analysed by the determination of e/m for charged particles (as in the mass spectrograph). The isotopes of each element have the same atomic number, so they have the same chemical properties. The atomic weights, however, are different. Magnesium has five isotopes, but only three are stable; the two other are unstable, having a very short half-life. It is a striking fact that, with few exceptions, for each element the relative abundance of the isotopes is the same once and for all. The exceptions are the elements Pb, He, C, O, N and S. Apart from these minor exceptions, it appears that in the early geological period in which minerals were formed, a certain isotopic constitution prevailed all over the whole material now accessible to our investigation. Figure 5.A. shows the isotopic constitution of terrestrial magnesium.

Isotope	% Natural Abundance	Half-life	Atomic Mass
Mg^{23}		11.9 sec.	
Mg^{24}	78.6		23.99189
Mg^{25}	10.1		24.99277
Mg^{26}	11.3		25.99062
Mg^{27}		9.6 m.	

Fig 5.A. Isotopic constitution of terrestrial magnesium

The higher density (1.866) of the unknown magnesium suggest an entirely different isotopic constitution--probably a preeminence of the heavier isotopes 25 and 26. Or it can be due to the presence of another isotope, still heavier, which is not found on our planet. In any case, it would be the absolute proof of the extraterrestrial origin of the metal.

Are the relative abundances of the isotopes of each element characteristic only for the earth? We don't know yet. The little material we have, derived from the investigation of meteorites (which presumably are members of our solar system, too), shows they present the same relative abundance as the elements known in the laboratory. If this could be proved for all the planets in our solar system, there would be another possible origin for the material--from another solar system.

So far we have no data concerning the isotopic constitution of the magnesium in the samples. It has to be determined with a special mass spectrograph of high precision.

There is not such an apparatus in my country. ~~The problem was already solved, but I don't know yet the results.~~

COMMENTS AND REMARKS

1--The absence of physical evidence--such as crashed saucers--was considered as the best argument against the existence of the UAOs. It was difficult to admit the reality of a flying machine so far advanced as to have reduced the probability of mechanical failure to near zero. Even to those who believed that UAOs utilized a principle of flight unknown to us. The Ubatuba incident, however, showed that the alien craft are not free of the failure factor--that they can be destroyed by unexpected failure of their flight mechanism, like any ordinary aircraft. But there is an important difference to be stressed. They never crash because of the peculiar characteristics of the accident. The effect of the failure is of such a kind that, in a split second, they explode with prodigious kinetic force; there is a vivid flash followed by desintegration and thermic volatilization in a few seconds, and the object vanish, in a shower of fiery sparks. No fragments or parts of the saucer are found in most cases, chiefly when the explosion occurs very high in the sky, because they are completely burned into cinders long before reaching the ground. In the Ubatuba case, two fortunate circumstances were the cause of the failure of this process. First, the flying disk was very low when the accident happened. Second, the explosion was over the sea. As a result, the fiery metallic debris reaching the ground fell into the sea and the magnesium fire was smothered. So, a number of intact small fragments that fell close to the beach were picked up. On the other side, it is true that water cannot be used for extinguishing a magnesium fire, because it will not usually put it out; the burning magnesium needs oxygen from outside and, at the high temperature of this action, it will burn in the oxygen of the water, setting the hydrogen free. But there is one exception, which explains the Ubatuba case. In fact, it is possible to stop the action by supplying a very great deal of cold water suddenly, and taking away the heat more rapidly than it is being produced. When this happens, we may find a certain amount of $Mg(OH)_2$--magnesium hydroxide--in the surface of the metal, instead of the oxide--MgO--that was to be expected from the oxidation in the air. There was magnesium hydroxide in the samples analysed; but magnesium oxide was not found in the material. The fact shows that the magnesium fragments were still at a high temperature when they reached the sea waters.

There is nothing theoretical or imaginary in all this. My deductions are inherent in the evidence itself. This evidence gives us a fairly clear picture of what happens with

the UAOs when their flight mechanism is suddenly put out of operation by an unexpected failure in the engines. It suggests an explanation for the absence of physical evidence of the accident in similar cases, and explains why it was present in the Ubatuba case.

2--Magnesium is the lightest structural metal. Its extreme lightness in conjunction with good mechanical properties explain the ever increasing use of magnesium alloys in the aircraft industry. The more recent application was in the manufacture of artificial satellites. The Sputnik I was made of a magnesium-aluminum alloy. The American satellite's shell was made with magnesium coated inside and out with gold (.0005-inch thick), and covered on the outside with layers of chromium, silicon monoxide, aluminum and silicon monoxide (total thickness of the multilayered shell: 1/33 inch). The gold coating and outer layers were added because magnesium cannot maintain the temperatures needed for the proper functioning of instruments. Its high thermal conductivity dissipates heat rapidly.

Commercially pure magnesium, however, has low structural strength and is not used in aircraft. In spite of this, the available evidence in the Ubatuba case showed that "flying disks" (at least partly) are made with super-pure magnesium. Other metals possibly existed inside the craft which were not found. The small fragments picked up at the beach near Ubatuba came apparently from the disk's shell. They showed that this shell was made with pure magnesium--a material with low structural strength. How can it be so? I don't know. But the properties of super-pure magnesium are not known. More and more it is being realized in chemistry and metallurgy today that trace elements have enormously potent effects. For example, iron that is really pure has a strength 100 times as great as commercially pure iron. Titanium, which is almost as strong as structural steel and as light as aluminum, fails miserably if it is contaminated with as little as .02 % of hydrogen. Accordingly, super-pure magnesium with perhaps undreamed of properties, can be well the metal of the future. Perhaps some day we shall be privileged to study its properties. Then we will know why it is used in the flying disks.

3--In order to ignite magnesium, it is first necessary for the metal to reach the melting point--650 C (1202 F). This high temperature was reached instantly when the craft exploded. "It disintegrated into thousands of fragments," reported the witness, "that fell sparkling with magnificent brightness, looking like fireworks in spite of the time of the accident (at noon). It is a perfect and precise description of a magnesium fire, of burning magnesium fragments(with its strong actinic light) looking like fireworks--even at noon. This evidence gives us a clear idea about the amount of thermic energy released in the explosion. It was not, obviously, a common explosion.

4--The mystery of this sudden explosion which disintegrated the UAO into thousands of fiery fragments, with such a terrific force, probably will never be solved. It could be produced, of course, by the release of some self-destroying mechanism, set to avoid the crash of an almost intact machine on our hands--giving us the chance of learning its secrets. There is also the possibility of an atomic explosion. We have some reliable evidence showing that UAOs are powerful radioactive sources§; and the Campinas' incident suggests that they use atomic engines of some sort. They could blow up by accident. But I would expect the debris of the explosion to be contaminated, i.e., highly radioactive. They were not. The metallic fragments were tested on an "Atomic Scaler" and there was no abnormal radioactivity. This evidence speaks against such a possibility, in my opinion. There is still a third possible cause for the disaster, perhaps the most interesting possibility: that of a sudden failure of the craft's flight mechanism. In fact, when the "flying disk" came down toward the sea, at terrific speed, it seemed to be in trouble and almost crashed against the waters. To avoid it, at the last moment it made a sharp turn upwards--just before exploding. It seems that the maneuver was fatal for the craft. Its propulsion system, already too much overloaded, apparently was not able to stand the tremendous strain brought by it, and ceased to operate suddenly. Then came the explosion. Why ?

Recent evidence (two sightings in France: at Vins-sur-Caramy, on April 14; and at Palalda, eight days later) shows that UAOs create a powerful electromagnetic field around themselves, so strong that iron objects placed inside such a field acquire long-lasting magnetic properties. These fantastically large electromagnetic fields of force are evidently connected with UFOs' propulsion mechanism. But no one knows how they are utilized. Unfortunately, we are just beginning to study the complex problems yet to be solved, in order to fill the gaps that still exist in the Unified Field Theory of A. Einstein. The science of of gravities, electrogravitics and electromagnetism is still groping in the dark, on our planet. So, we cannot know how those force fields are used to neutralize the gravitational pull of the earth--and to propel the UAOs through outer space (perhaps some unknown application of Lenz's Law?). Anyway, such fields seem to act also on the air surrounding the craft, when it is flying through the atmosphere--dragging the adjacent molecules of air along with it, at speeds varying with their proximity regarding the machine. This effect protects the UAO against overheating. Even at enormous speeds, the heat produced by friction, instead of being concentrated on the surface of the machine, would be dissipated in this thick layer of air carried along with it. Now, what happens if the mechanism creating the force field fails unexpectedly ? The field would obviously vanish at the same instant.

§ - Ruppelt, E. J.: The Report on Unidentified Flying Objects (chapter fifteen). Doubleday & Co., Inc. Garden City, N.Y., 1956

If the force field collapses, the surrounding air ceasing to be carried along, that thick layer of air around the saucer disappears too (1). If the UAO was traveling at speeds between Mach 4 and Mach 8, at that moment, it continues on its course and strikes against the motionless and elastic barrier of air ahead with tremendous kinetic force (2). Its equilibrium temperature instantly passes from the normal to white heat. Thermic disintegration is a matter of seconds: with a vivid flash (and sometimes a noise like a thunder), the craft explodes in flames or dissolves into a shower of sparks (3). If the speed is very high (as in the Ubatuba accident), these three stages blend into a terrific explosion.

5--The preceding discussion showed that the problem of the so-called "thermal barrier" was solved by those who built the UAOs. But their approach was very different from ours. We are already beginning to probe this new frontier, as our planes approach thermantic (from Mach 2 to Mach 4) and superthermantic (from Mach 4 to Mach 8) speeds. In the thermantic region (1.325 to 2.650 mph), stagnation temperatures (air's original temperature plus that caused by friction of the plane moving through it) range from 250º to 1500º F. They vary from 1.200º to 6.300º F., or more, in the superthermantic region. In relation to equilibrium temperatures (the ones of the metal on an airplane), the picture is much less severe. In the thermantic region, for example, they get up to only 900º F. But the result, of course, is still heat, and plenty of it. Tomorrow's airplane may glow red and give off enough heat to warm up 400 average-sized homes while reaching its equilibrium temperature at a speed of Mach 8 at 180.000 feet. To win the fight we are trying a endless search for better and better heat-resistant materials and cooling systems. Now, equilibrium temperatures depend and are based on a factor of which we have little knowledge. It is the boundary layer, a thin film of air that rides along rugging the airplane's surfaces as it rushes through the air. It can be laminar (smoothly following the contours of the plane's surface) or turbulent--depending upon speed and altitude. Its thickness decreases to practically zero at leading edges (places that bear the brunt of the plane friction with the air); temperatures are consequently far higher at these areas. Its importance to temperature (we believe) is that heat is transferred through turbulent boundary layers at much higher rates than through laminar layers. But we are not interested in it....

On the other hand, the UAOs can travel through our atmosphere at speeds between Mach 4 and Mach 8 or more, with no trouble about the thermal barrier. Are they made with materials better than Pyroceran or Inconel-X ? No, they are built with magnesium, a low heat-resistant material we do not use. How can it be ? It can be, because they can control the mysterious boundary layer and make it very thick and turbulent.

This possibility had been already suggested by Lieutenant Jean Plantier (of the French Air Force) in a recent book about UAOs' propulsion system §. But now we have something more convincing, we have evidence to make it almost a proved fact. The "flying disk" that exploded near Ubatuba was made with magnesium. It obviously could never stand the fantastic speed it was traveling when first sighted. Its magnesium outer shell would loose its strength and would be burned by friction with the air around in a few seconds--at speeds far below that one. But nothing happened; it showed no sign of overheating at any time, and it did not burn. There is no other alternative: there was something around the craft protecting it against overheating--the artificially created and controlled boundary layer, already described. The connection between this effect and the propulsion system utilized by UAOs was already discussed.

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SUMMARY

1 - An unconventional aerial object--a "flying disk"--exploded in flames over the sea, close to a beach near Ubatuba, São Paulo. It happened at noon, on early September, 1957. The alien craft was going apparently to crash in the sea; it came down toward it at unbelievable speed. But, at the last moment, it made a sharp turn upwards and climbed up on a fantastic impulse. The explosion came just after this controlled maneuver to avoid the crash. The UAO disintegrated into thousands of fiery fragments which sparkled with magnificent brightness, even at noon. They fell in the sea, most of them, but a number of small pieces fell close to the beach and were picked up by the witnesses. The author got three small samples of this material.

2 - A careful chemical study of the disk's fragments was made. The analyses were done by reliable technicians at a Federal Laboratory. The spectrographic analysis and the X-ray diffraction analysis were the methods employed.

3 - The material was found to be metallic magnesium of absolute purity (100.00% Mg). Even the infinitesimal quantities of "trace" elements that are always found in the samples of pure magnesium, traces so small that they couldn't possibly be identified by any other means, were not detected. There was no impurity in the samples.

4 - These extremely interesting and truly incredible results of the chemical analy-

§ - Plantier, J.: "La Propulsion des Soucoupes Volantes par action directe sur l'atome." MAME Ed., Paris. 1955.

REPORT ON THE INVESTIGATION OF MAGNESIUM SAMPLES ORIGINATED IN THE EXPLOSION OF A UFO OVER THE SEA IN THE REGION OF UBATUBA, BRAZIL

By Olavo T. Fontes, M.D.

It is widely known that since the year 1947 many people in many places have reported "flying saucers" and other strange objects in the sky. But the absence of physical evidence -- such as crashed "saucers" -- has been considered as the best argument against the existence of such UFOs. In fact, it is difficult to recognize the reality of a flying machine so far advanced as to have reduced the probability of mechanical failure to near zero. Major Edward J. Ruppelt, USAFR, in his excellent book, "The Report on Unidentified Flying Objects," stated that the USAF had never picked up any "hardware" -- any whole "saucers," pieces or parts -- that could not be readily identified as being something very earthly. I believe him. But I also believe that he was aware of the possibility of a UFO crash at any time -- if UFOs existed, of course -- giving us something more concrete than the circumstantial evidence we had before about them.

Such an unexpected occurrence was reported, at last, from a place near the Brazilian coast. A disc-shaped object exploded over a seashore. Fragments recovered from the explosion were supposed to have fallen, while burning, into shallow waters, which, according to the witnesses, quenched the fire and allowed recovery. I cannot vouch for the above story, but only for the identity of the samples received and the details of the investigation ~~to be~~ reported. But the story of the origin of the samples will be of interest in connection with the results of the chemical analyses ~~to be~~ reported.

Anyone who can learn anything is constantly reminded that he does not know everything. If he is, in fact, learning -- not assuming the attitude of one already knowing, or pretending that the unfamiliar is not worth knowing -- he is not likely to be thrown into a panic if his mind feels the touch of the unknown. Because he knows the unknown is here. And that it is not something to be feared if it cannot be avoided; or something to ward off, explain away, exclude, reject, distrust or even destroy. He does not reject knowledge and he is not fearful of it, not fearful of moving beyond it -- but at ease with its problems and possibilities.

This report was written for people of such a kind all-over the world. It is concerned to what appears to be the final proof, physical proof, of the existence and extra-terrestrial origin of the UFOs.

CASE REPORT

On September 14, 1957, Mr. Ibrahim Sued, a well-known social columnist at Rio de Janeiro, reported a strange story which startled the readers of his column in the newspaper " O GLOBO." Under the heading, " A fragment from a Flying Disc," he printed the following information (transcribed verbatim):

" We received the letter:

' Dear Mr. Ibrahim Sued. As a faithful reader of your column and your admirer, I wish to give you something of the highest interest to a newspaperman, about the 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 some friends at a place close to the town of Ubatuba, Sao Paulo, when I sighted a flying disc. It approached the beach at unbeliavable speed and an accident, i.e., a crash into the sea, seemed imminent. At the last moment, however, when it was almost striking the waters, it made a sharp turn upwards and climbed up rapidly on a fantastic impulse. We followed the spectacle with our eyes, startled, 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 these 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 as light as paper. I am enclosing a small sample of it. I don't know anyone that could be trusted to whom I might send it for analysis. I never read about a flying disc being found, or about fragments or parts of a saucer 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 adress. '

" From the admirer (the signature was not legible), together with the above letter, I received fragments of a strange metal ...." UNQUOTE.

The unusual story stirred up my curiosity. Mr. Ibrahim Sued had never written about UFOs before. My first idea was that the whole thing should be a joke or a well-planned hoax. I tried to convince myself that this was the obvious explanation and to dismiss the matter, but soon I felt that something more should be done to clarify the doubts raised in my mind. I had to contact Mr. Sued to take a look at the "fragments" and find out the answer I was

looking for. I phoned him that same day and asked for a meeting to discuss the matter. He agreed. I arrived at his apartment four hours later. There, on the table, I saw the sample sent by the unidentified correspondent.... Three small pieces of a dull-grey, solid substance that appeared to be a metal of some sort. Their surface was not smooth and polished, but quite irregular and apparently strongly oxidized. The appearance suggested they might be, if really metallic, pieces or fragments disintegrated from a larger metallic mass or object. In fact, the surface of one of the samples was shot through with almost microscopic cracks always longitudinal, and even showed a large longitudinal fissure at one face, running through almost two-thirds of its length. As if that piece had been disrupted under the action of some force. The others did not show (many) cracks or fissures, but the surface of all samples was covered at scattered areas with a whitish material, which was obviously non-metallic. These whitish smears were produced by deposition of a powdered substance, ~~on a~~ thin layer. The fine dry powder was aderhent but could be easily displaced with the nail. It also filled the fissures and cracks on the surface of the first sample described. Such a powder presented some similarity with the whitish powdered cinders on a chunk of burned charcoal — as if the fragments had been scorched by some fire, or injured by too much heat. Two of these samples were later photographed still in their original form. The photos are presented in another part of this report.

When I picked up one of the fragments, Mr. Sued, who was watching me, said the material appeared to be lead at first sight — because of the grey color. But I would see that it could not be lead, a heavy metal, if I felt the weight of the sample in my hands. He was right. The material was light, definitely lighter than aluminum - almost as light a paper. Amazed, I told him that I had some friends with scientific background who might be called to investigate the samples. They certainly would be interested to analyze a small chip of that substance. He answered that he knew nothing about UFOs and was even convinced they did not exist. Therefore, he was not curious about the samples and I could take them to my friends, if this was my purpose. Of course, he would appreciate to know about the results if something unusual was found in the analysis. I thanked Mr. Sued for his generous attitude, promissing to keep him informed, and picked up the samples.

PRELIMINARY EVALUATION OF THE WITNESS'S REPORT

On examining the data reported on the UFO's explosion and the supposed origin of the samples, I concluded that they offered insufficient solid information for a definite conclusion. A few points, however, attracted my interest. They are listed below:

1. Mr. Sued's correspondent seemed to be very sure about the accuracy of his

observation. He had identified the object sighted as a "flying disc." No more detai s wer given. This is a good point on his side. In my experience of psychology applied to the investigation of UFO's sightings, I have learned that the reliability of "saucer reports" varies inversely with the detail that the observer reports. The hoaxes are almost always marked by the accurate and precise description of detail, in such a way that we feel the witness was obviously drawing on his imagination. In this incident, however, the observer did not present a vivid description of the "saucer," or of its crash. His story is simple clear and concise as it would be expected in a true case. Besides, in a case where everything was supposed to have happened in just a few seconds, it is evident that no more details could be expected about the curious object. Apparently the thing was too rapid for t human vision to fix any detail of the object, except the general shape and trajectory.

2. The man who supplied the samples said that the phenomenon was also witnesse by other persons. This may give more credence to his report, if proved to be true. In fac one person might have a delusion or hallucinations, but they won't be seen by a friend.

3. He was not apparently one of the so-called "saucer cultists." He said he ha never heard about "saucer" fragments or parts being found, or about a "saucer" crash. A cultist would have another attitude. A cultist would comment about those possibilities as "verified facts," hidden by the authorities as a part of their great conspiracy to distor the truth about the UFOs. A cultist would strip his report of any information that could point to a natural explanation, or suggest a man-made pyrotechnic device. A cultist would report "correct" estimations of height, speed, size and distances involved, and would tre them as accurate data; he would probably make an enthusiastic discourse about the value of the "physical evidence" he was sending to Mr. Sued. Doing nothing of that, the person who wrote the letter cannot be classified as a "saucer cultist," at least in this preliminary evaluation of his report.

4. He could be a hoaxer, but a poor one. A good hoaxer would have presented his case in a press-conference in order to get a lot of publicity for himself. He would never start with a timid letter to a wrong person, to a social columnist who possibly would not be interested on the matter. Most of all, he would never send the "disc's fragments" toget with the first letter to the newspaperman, before knowing Mr. Sued's attitude about UFOs a his possible reaction to his story.

5. If he thought he saw a "saucer" (and we have not a valid reason for doubting the objective report of the incident, without anything to support our suspicion), then he must have seen something. To get a reaction from one of the senses there must be a stimulu

We do not know yet if such a stimulus was represented, in fact, by a "flying disc" as claimed by the observer who supplied the "fragments." However, it must be emphasized that no known optical or natural atmospheric phenomena fits the reported facts. The reported aerial object which exploded still in the air could not have been a man-made missile or vehicle. No natural object of meteoritic origin, or man-made machine, traveling at terrific speed, has ever been seen making such a sudden upward turn. No human being would have risked to see his machine destroyed and himself crushed by the tremendous "G" load brought to bear on the craft during its abrupt vertical veer, as it happened just before the explosion, as reported by the witness.

6. The observer identified the unknown object as a "flying disc." He did not use the popular denomination, "flying saucer," a name which would be misleading because it is commonly applied to unconventional aerial objects of every conceivable shape, to anything in the sky that cannot be identified as a common, everyday object. ~~As~~ in Brazil the term "flying disc" is used only in connection with disc-shaped UFOs — unconventional objects other than "discs" having different denominations, such as "flying cigars" for anything cylinder-shaped, "fireballs," for flying spheres or burning ball-shaped objects, etc. — — we could be reasonably certain that the witness really sighted a disc-shaped UFO, if the study of the "fragments" could produce valid reasons to support his report. Anyway, these considerations about the object's shape are points to be stressed in this case, chiefly because no details were reported on the object's structure.

7. The man who supplied the samples was not aware, apparently, that the first man to lock down physical evidence on the interplanetary hypothesis of UFO origin, or on the bare question of the reality of the phenomena, would go down in History, ~~with a big name.~~ He would not give away his samples, sending another copy of his letter to Mr. Sued, together with other pieces of the material, to the newspaper "O GLOBO." ~~Incidentally, these~~ other samples were received but are lost.... Such a behavior might be understood only if the sender was a very ~~clever hoax~~ (perhaps too clever...), doing it on purpose to explore the situation later, or a person who was sincerely puzzled and did not know anything about the real importance of his finding.

The reasons listed above explain my interest to obtain the samples and make a scientific investigation of such a material. In an ordinary case the first thing to do would be an investigation to find out more about the sighting itself. I could stop at this point and send someone up to the Ubatuba region immediately, to search for the witnesses involved and get more data from them on the sighting. But in this unusual case there was evidently a better approach to the problem, in order to do a scientific evaluation. In fact,

there was something that, if properly evaluated, could be of real value for a definite opinion on the reported sighting. That something was represented by the "hardware" supplied by Mr. Sued's correspondent — i.e., the "fragments" of the UFO that was blown to bits in an aerial explosion right before his eyes. A chemical analysis of such a material was the obvious thing to do, and it could give us one of the following results:

(1) - It could readily identify the material as something very earthly. For example, as iron, aluminum or even ordinary solder, any well-known metallic alloy, a non-metallic substance, etc. In this case the samples would be of absolutely no interest, and the story should be discarded as a fairy tale or hoax.

(2) - It could identify the material as something existing on our planet, not as a natural substance, but as a product of human technology that was hard to be obtained or processed. For example, as a commercially pure metal or special alloy. The story of the samples' origin could be true, in this case, but a full investigation of the witnesses would have to be completed in order to evaluate the reliability of their reports — before any conclusion about the incident itself.

(3) - As last possibility, it could identify the material as an unknown substance; as something not found on the earth, nor of established meteoritic origin; or as an unknown metallic alloy; or as a metal more pure than any commercially pure sample available, with characteristics which require complex and time-consuming operations so that the final product becomes more costly than gold, and cannot be prepared in scale large enough to be of industrial application (for instance, for the fabrication of a human artifact, aerial machine or device); or as a metal with such a high degree of purity, that its chemical characteristics approach the ASTM "standard of purity" for the same metal — a finding which would make it impossible to explain even the quantity of that metal in the samples analyzed; or as a metal with chemical characteristics, or intrinsic properties, or degree of purity, far beyond the possibilities of processing methods and technologies of terrestrial Metallurgy. In any of these cases, the analysis' report on the material would constitute enough evidence, at least to prove that UFOs are real objects. In the case of a special alloy or processed metal, the evidence would be enough to demonstrate that UFOs are "artifacts" — made by human hands, or of interplanetary origin. And in the case listed as last possibility, such a metallic sample would represent definite evidence — physical proof — that UFOs can be only craft of interplanetary origin, excluding definitely the hypothesis of natural phenomena or man-made secret aerial machines (secret military weapons, for instance).

As the peculiar appearance of the metallic samples (if they were really metallic) indicated that they could well be "fragments" originated from the explosion of a larger

metallic mass or object; and that they had been burned or scorched by some kind of fire, or heat -- I decided to enlist the help of highly qualified chemists of considerable repute to aid in the investigation of the samples. Those peculiarities of the material,as well as its obvious light density, constituted a real puzzle that only a scientific investigation might solve. I confess I kept the samples for seven days before reaching any decision about the measures to be taken. At last, I decided to send the material to a highly-qualified Laboratory, one of the best in my country.

THE CHEMICAL ANALYSES: MATERIALS AND METHODS

The samples to be investigated, the fragments claimed to have originated in the "explosion" of the UFO reported, were turned over to a Government Laboratory, the "Mineral Production Laboratory," which is a division of the National Department of Mineral Production This department is a Federal organization, a branch of a Government Institution -- the Agriculture Ministry of the U.S. of Brazil. The Mineral Production Laboratory is the official Brazilian institution for examination and analysis of mineral substances, metallic ores, metals and alloys. The samples were registered there as being of "unknown origin," and delivered personally to Dr. Feigl, the chief-chemist. I did not know him and was introduced by a friend, Dr. Julio de Morais. I hoped that this famous German chemist would be the scientist that was going to conduct the investigation of the samples. At that moment, however, he was doing experimental studies on organic chemistry and researches on plastics. He ~~said~~ me he could not make the investigation personally. He called for one of his assistants, Dr. David Goldscheim, who made a careful examination of the samples and suggested that their physical appearance indicated they might be fragments of meteoritic origin. But Dr. Feigl refused to accept such a possibility.

" They are too light to be fragments of a meteorite," he said. " They appear to be metallic, made of a lightweight metal. But this metal is not aluminum. I am going to make a chemical test...."

A small chip of the material was placed in a test tube. A few drops of phosphomolybdic acid were added, plus a few drops of dilute hydrochloric acid. It was a qualitative screening test to identify metals. If the material was metallic, a blue color would appear in the test tube (phosphomolybdic acid is easily reduced, when in presence of a reducing agent, to produce the blue-colored mixture of colloidal reduced oxides of molybdenum). No change was detected at first; but, when the test tube was slightly heated, bubbles appeared on the surface of the material and the blue color was observed. Thus, the material (or part of it) was really a metal of some sort.

It was decided that a Spectrographic Analysis should be made for the identification of the unknown metal in the sample, and to establish the presence of other possible constituents. The decision was a wise one, for the spectrographic method is extremely sensitive. It ~~makes~~ possible to determine the chemical composition of a piece of metal no larger than the head of a pin. By using it, minute traces of elements can be detected in large amounts of other elements, traces so small that could not be possibly detected by any other means. ~~All~~ metals, as well as gases and a few non-metals, ~~have~~ a spectrum which is uniquely its own, whether it consists of two lines (sodium), or thousands of lines (iron), and whether the element is alone or in combination. Each element, when excited in the proper conditions, gives its spectrum; and all compounds are resolved into their components.

One of the"disc's fragments" (that will be referred as "sample 1") was preliminarily divided in several pieces. Two of these metallic pieces, weighting approximately 0.6 grams Gm. each, were sent that same day to the Spectrographic Section of the Mineral Production Laboratory. The others were returned to me again, to be kept for other analyses (if necessary). The remaining two "disc's fragments" still in my hands were also set apart for any future investigation. These were later photographed. Unfortunately, no picture was taken of sample 1 in its original form and this was a real oversight. Only an apology is now possible. The photos are shown below (Fig. 1.A. and 1.B.):

- Fig. 1.A. -

- Fig. 1.B. -

The large sample in the photographs (that will be referred as "sample 2") shows clearly the longitudinal fissure and small cracks described previously. The smaller one (that will be referred as "sample 3"), which also presents a few small fissures, has a peculiar curved cross-section. This peculiar shape might suggest that it came from a curved shell, a spheroid object, or a dome-shaped device. Both samples present a quite irregular and apparently strongly oxidized surface. Their dull-grey color contrasts with the whitish areas covered with the powdered material already described. This material, ~~obviously non-metallic,~~ was presumed to be an oxide of the metal in the samples, possibly formed when the samples were at ignition temperature and exposed to air.

I was curious about the results of the spectrographic analysis to be made. I knew that the presence or absence, in the unknown material, of seventy of the chemical elements would be revealed by the Spectrograph; and that no element of ~~such~~ a group could be missed if it constituted as much as the one-millionth part of the whole.

It was planned that the material, if necessary, should be also investigated by other methods. The ~~other~~ methods suggested were the following ones: (1). a standard "semi-quantitative" spectrographic analysis; (2). a X-ray diffraction analysis; and, (3) a

special "mass spectrograph" analysis.

THE CHEMICAL ANALYSES: RESULTS OBTAINED

I - SPECTROGRAPHIC ANALYSIS -

The official analysis of the two metallic pieces taken from sample 1, was made on September 24, 1957, by the chief-chemist of the Spectrographic Section of the Mineral Production Laboratory, Dr. Luisa Maria A. Barbosa, chemist--technologist specializing in spectrochemical analysis and highly qualified for the part she played in the investigation. A routine exposure was made first in order to identify the metal in the sample. One of the metallic pieces was used for this exposure, which was burned in an arc between standard electrodes while an exposure of fixed length was made. The metal in the sample was identified as magnesium. Then a second exposure was made in order to determine the purity of the metal and to detect other possible elements which could be present in the sample. The other metallic piece was used for this procedure. This exposure was made by a special method prescribed for highly-sensitive analyses. The instrument used was a large Hilger Spectrograph used when more precise and reliable results are desired. The official report on this spectrographic analysis, signed by Dr. Luisa Maria A. Barbosa, was received a few days later. A photocopy of this report is shown below (Fig. 2.A.):

- Fig. 2.A. -

A translation was made of this report, for a better understanding of its terms. It is shown in Fig. 2.B.

- Fig. 2.B. -

The conclusion is that the magnesium in the sample was of very unusual purity, with no detectable inclusion of other elements. The report of the chemist who interpreted the film indicated that the magnesium in the samples was pure in the spectrographic sense. But I confess that I would expect a more detailed description of the results found in the analysis. Not satisfied, I went to the laboratory on September 30, 1957, in order to meet Dr. L. M. A. Barbosa and ask for an additional explanation on the subject. I tried to impress upon her the necessity of a more detailed report including technical data concerning the spectrum lines recorded on the photographic plate, instead of a single conclusion as in the report she had released. We talked for almost an hour. She did not like it. She said I had no authority to appraise the merit of her work; that if I was a chemist I would be satisfied, but I was not. So my opinion was not important, etc., etc. I tried all arguments to convince her, but she stubbornly refuted my reasons and refused to consider my request for an additional

report on the spectrographic analysis. At the end, I asked some questions about the results obtained and the interpretation of the spectrographic data. A summary of the questions and respective answers is transcribed below:

Q. Your analysis showed the presence of magnesium of very unusual purity, and absence of any xx other metallic element. Right?

A. Yes. I identified on the film all common and uncommon spectrum lines of the element magnesium. There was no other metallic element in the sample, not even the so-called "trace elements" usually detected in metallic samples.

Q. Your report suggests that the metal in the sample was absolutely pure in the spectrographic sense, with a percentage of 100 per cent. But you did not state this, which is a very interesting conclusion. Why?

A. Because a pure metal in the spectrographic sense may still contain other possible constituents, which could be present in your sample and escape detection. The method has its limitations. Different compounds or states of combination of the same element, for instance, are not distinguishable by spectrographic analysis. Most of the non-metallic elements are not detected by it — the exceptions are very few. Thus, in this particular case, it could be a mixture of the element found with any of its compounds, or a chemical combination with any of those non-metallic elements. A salt, for example, despite the fact that the appearance of the sample suggests the element as being in its metallic form.

Q. I understand your point. Now, I would appreciate to see the spectrographic plate.

A. Of course. Here you have it (and showed me the film). You can see five spectra on it. The spectrum corresponding to the sample analyzed is the first one, on top of the film. It shows a number of spectrum lines with different strengths, but all of them belong to the same element — they represent the spectrum of magnesium, as you already know. The other four spectra were made for comparison purposes. The third one is also a magnesium spectrum and corresponds to a chempur magnesium salt (CO_3Mg). The remaining spectra (second, fourth and fifth) are iron (Fe) comparison spectra.

And here ended my interview with chemist L. M. A. Barbosa. A photocopy of the spectrographic plate referred above was requested later. It is shown below (Fig. 2.C.):

- Fig. 2.C. -

This was not the only spectrographic analysis made to study the samples. In order to overcome any lack of basic data, to confirm the results of the first investigation, and to obtain a more accurate evaluation of the findings, I decided to request a second spectrographic analysis of the material. It was made on October 24, 1957. At this time, an X-ray dif-

fraction tests had been also made. The findings of these analyses, which will be presented and evaluated in the next portion of this report, constituted an additional reason for the need of another spectrogram to check the results of the previous examination. It was made on October 24, 1957. Another metallic chip taken from sample 1 was used for this procedure. The instrument was again the Hilger Spectrograph. The chemist who conducted the analysis was Mr. Elson Teixeira, a man highly qualified for the task. For fifteen years, he had been the chemist who handled spectrochemical analysis at the Mineral Production Laboratory; his experience included more than 50.000 spectrographic determinations and his skill was such that this task caused no worry; he had left the job a few years ago to become a business man, but he still had licence to use the laboratory's facilities for anything he wanted. He agreed to make a second spectrogram of the magnesium sample — instead of doing a second report on the analysis made by chemist L. M. A. Barbosa (for ethical reasons). His problem was to decide whether or not the magnesium was, as showed by the previous investigators, of absolute purity. He used special technical procedures to control the many variables that might influence the results (such as atmospheric contaminents, dirty electrodes, etc.).

The report of Mr. Teixeira's particular analysis was translated and transcribed verbatim. It can be seen below (Fig. 3.A.):

- Fig. 3.A. -

He had planned also a "semi-quantitative" spectrographic analysis to establish the percentages of any possible impurities not detected in the previous spectrogram of the magnesium sample. But his analysis confirmed the reported absence of impurities of any kind and, because of this, he considered the "semi-quantitative" test as obviously unnecessary and useless.

The spectrographic film corresponding to chemist Teixeira's analysis was sent to the writer. A photocopy of this film is seen below (Fig. 3.B.):

- Fig. 3.B. -

Incidentally, the two spectrographic analyses included in this report were the ones available to the writer — but not the only which were made for the magnesium samples. In fac a third spectrographic study of the material was conducted in a military institution. Some one informed the Brazilian Army about the case, and the writer was contacted by Major Roberto Caminha who requested a sample of the material for examination and a written report on the incident. He received them on November 4, 1957. The analysis was made at the I.T.M. (Military Institute of Technology) but the writer was not informed about the findings obtained. It was said that a complete investigation would be ordered by the Brazilian Army on the incident but this writer was unable to confirm the information and cannot vouch for it.

A small metallic chip of sample 1 was supplied for the Army examination. Another small fragment of the same origin (the last remain of sample 1) was given, a few months later, to Commander J. G. Brandao, a Brazilian Navy officer who contacted this writer to make a similar request. No information was obtained concerning the methods used and the results found in this last investigation, but there are reasons to presume that a spectrographic test (the fourth one) was made at the Navy Arsenal, Rio de Janeiro.

II - X-RAY DIFFRACTION ANALYSIS -

As the spectrochemical analysis made by Dr. L. M. A. Barbosa indicated that the metal in the samples was pure in the spectrographic sense, tests of other kind became necessary to correct the limitations of the spectrographic method, and to investigate the possibility of non-metallic impurities in the material. The remaining fragments of sample 1 were then sent to the Laboratory of Crystallography of the "Geology and Mineralogy Division of the National Department of Mineral Production" -- for X-ray diffraction studies. The director and chief-chemist of this research institution, Dr. Elysiario Tavora Filho, is a well-known scientist -- he is famous in my country because of his pioneer works on Crystallography since 1949. He is the Brazilian top-expert in the field, and also has the position of Professor of Mineralogy at the National Chemistry School. He was responsible for the results that will be presented here. In the writer's opinion, his work could not be more perfect -- it is complete in every detail and flawless.

It is evident that the X-ray method of chemical identification was obviously indicated to complete the results obtained with the spectrographic analysis of the magnesium samples. The important advantages of the procedure are that only small quantities of the material to be investigated are required (just a few mg.), and that different compounds or states of combination of the same elements are distinguishable from each other, since they possess different crystal structures. It is widely used for the identification of alloy phases. If more than one variety of crystal is present in any specimen, each will produce its spectrum independently (a very important fact to remember), and the pattern will consist of superimposed spectra with relative intensities depending on the relative amounts of the phases. Thus, the constitution of inorganic and organic systems, minerals, and alloy systems can be determined with accuracy through X-Ray Crystallography. Besides, X-rays also are applied for chemical analysis through the use of X-Ray Spectrometers that record the characteristic X-ray emission lines, or absorption edges, of the sample to be examined. Favorable combinations of elements permit extreme sensitivity in the detection of small percentages of an element in a compound or mixture (independent of the state of chemical combination),

and also permit fair precision in quantitative analysis (1).

As the precise results of X-ray diffraction analysis, together with the advantages specified above, make it a sensitive method to determine the composition and structure of metals, it was decided to use this analytical procedure in the investigation of the magnesium samples. The conclusion that the metal was of absolute purity (in the spectrographic sense), with no detectable inclusions of other elements, was something all previous investigators hesitated to accept without a confirmation by another method.

A preliminary identification of the samples supplied,by X-Ray Spectrometry, confirmed the previous report. The metal was really magnesium — and appeared to be of very unusual purity, with a percentage of about 100 per cent. Amazed by this truly incredible result, Prof Tavora repeated the spectrometric examination several times — always with the same findings. He then decided to request a careful re-examination of the spectrographic plate to re-check the reported results of the spectrographic analysis. One of his assistants, chemist Augusto Batista, was sent to the Mineral Production Laboratory with that mission. I was informed about these unexpected developments. I was puzzled but failed to recognize the significance of Prof. Tavora's attitude. He had adopted also a reserved attitude concerning the motivations behind such a decision, and I was unable to get any clue from Dr. Batista. As I was informed later, Prof. Tavora had realized, at that time, the full implications of the reported absence of any impurity in the samples. The X-ray diffraction diagram obtained matched a standard diagram of high quality, available for comparison, printed on a card from the current X-ray powder data file (and its accompanying Index volume). That "standard" diffraction pattern had been produced, however, using the available ASTM standard of purity for magnesium (ASTM 4-0770) — which still showed, in the spectrographic analysis, several impurities. The conclusion was that the magnesium in the samples would be purer than the ASTM "standard of purity" for that metal. It would be a truly incredible discovery, one that could not be accepted easily. Therefore, a verification of the spectrographic analysis was ordered. When he saw the reported results confirmed, Prof. Tavora was probably inclined to reject the whole thing at first sight. But he had no choice. As a true scientist, he could not discard the hard, cold facts of the evidence obtained with the previous analysis. So, he decided to use the most sensitive procedure available at his laboratory to settle the question, if possible. He decided to make a careful and complete study on the powder diffraction pattern of the magnesium in the samples, using the Powder method.

(1) - G. von Hevesy: Chemical Analysis by X-Rays and Its Application. McGraw-Hill Book Co. New York, 1932.

Prof. Tavora's Laboratory of Crystallography is equipped with the more elaborate and sensitive instruments and accessories for X-Ray Diffractometry and Spectrometry available anywhere. A powder camera of the Debye-Scherrer-Hull type was employed. A fine-grained polycrystalline specimen of the magnesium sample was prepared. Its diffraction pattern was recorded on a special photographic film (of the cylindrical type) and that film was object of careful examination. From the position of the lines on the film — the so-called "Debye rings" — — the spacing d of the corresponding atomic planes was determined. From the X-ray picture supplemented by other data, Prof. Tavora determined space lattices, the spacing d already mentioned (interplanar distance), and the values of θ. The relative intensity of each line (or arc) on the film was also measured. The pattern obtained matched the diffraction pattern of the ASTM standard of purity for magnesium referred above (ASTM 4-0770). All lines in the film were accounted for with the exception of six very faint ones. These did not correspond to the metal. They indicated that the sample contained inclusions of an unknown crystalline substance, which was present in very small amounts.

Was it the impurity(s) the chemists were attempting to detect since the first examination? The identification of this unknown material was the next thing to do, for obvious reasons. But the task was going to be difficult because the unidentified component was not present in sufficient amount to give a characteristic diffraction diagram. In fact, the six reflections in the film which were not accounted for were too weak to be used for that purpose A possible method to solve this problem was to expose different films for different lengths of time, thus making possible the measurement of strong intensities on one film and weak intensities on another. However, Prof. Tavora decided for another approach.

The appearance of the "fragments" suggested that they had been at some time subjected to violent oxidation over all their surfaces, which were covered with a powdered non-metallic material presumed to be magnesium oxide. This oxide, in Prof. Tavora's opinion, might be possibly present within the body of the samples — as the unidentified constituent. A plausible theory, which was consistent with the claimed origin of the samples. The oxide formed on the surface of molten magnesium exposed to air would be present within the metal as a result of oxygen diffusion through the samples at ignition temperature. A microscopic examination made by chemist A. Batista showed findings that appeared to support that theory. In fact, some of the small magnesium chips (taken from sample 1) examined, at points that corresponded to the surface of the original "fragment," were covered with the powdered substance and showed a few cracks and small fissures also filled with the same material. At these areas, the crystalline metal was shot through with fissures containing that material, too. On the other hand, it was true that such areas were scattered and small — most of the samples showing only

the crystalline pattern of pure metal. Besides, powdered specimens showed, under microscopic examination, only a kind of crystal — they did not present any visible trace of the non-metallic inclusions. Obviously, the mixture was not homogeneous; the non-metallic component was more abundant in areas close to the surface of the original sample; it might be present within the metallic mass, but in very small amounts. Possibly, in sufficient amount to explain the six unidentified faint lines on the film. As to the grain structure of the metal itself, chemist Batista said he was almost sure that the samples were fragments of a magnesium casting. Unfortunately, their appearance suggested they were not from the surface of the original casting, but came from <u>within</u> the metallic mass disrupted in the reported explosion; as a result, no information could be obtained on the thermal and mechanical treatment involved in the production of the casting referred to. He also verified that the heat developed in the fragments when they were at ignition temperature had influenced physical and chemical properties at the surface of the molten metal -- but apparently was too brief to produce gross melting or other recognizable changes in the grain structure. The accuracy of these observations was apparently confirmed by the diffraction pattern found for the magnesium in the samples.

The findings listed above supported the hypothesis that magnesium oxide was the unknown component. As the patterns of known materials can be used to identify the composition of an unknown constituent, the diffraction pattern of magnesium oxide was studied. It was found that the unidentified lines on the X-ray film did not belong to that pattern. In such a case, the composition of the dry, white powder on the surface of the samples should be determined too — a second diffraction pattern was made using this material. As a result, the non-metallic powder was identified as magnesium hydroxide ($Mg(OH)_2$), plus magnesium in its metallic form. The hydroxide was obviously the unknown component already detected, for the unidentified lines on the first film corresponded with the diffraction pattern of this substance. No evidence was found concerning magnesium oxide, which was not present at least in the samples analyzed (taken from sample 1). If a surface film of oxide was eventually formed while the molten fragments were falling through the air, or during the initial melting stage, it certainly was removed when the heated metal was cooling rapidly — into the sea waters. It is evident, on the other hand, that the hydroxide in the samples was not a constituent of the metal in its original form, appearing as an effect of oxidation in contact with water. As an effect of the fall, into the sea, of burning magnesium fragments — if the story of the sample's origin is true....

The diffraction patterns recorded for magnesium and magnesium hydroxide are presented below, side by side, in photocopies taken from the original photographic films (Fig. 4.A.):

- Fig. 4.A. -

The X-ray diffraction diagrams determined for each material, in comparison with the standard diagrams of the respective ASTM standards of purity, are presented in Fig. 4.B., which is a photocopy of Prof. Tavora's original report on the X-ray diffraction analyses of the magnesium samples.

- Fig. 4.B. -

For those who possess the technical background necessary for interpretation of technical data presented in the previous figure, a translation of Prof. Tavora's report (Fig. 4.C.) is presented:

- Fig. 4.C. -

A written statement promised by Prof. Tavora Filho about the possible origin of the magnesium samples, in the light of the data obtained with X-ray diffraction analyses, was not received. Due to the unexpected results found, Prof. Tavora decided later that only numerical data and photocopies concerning the analyses made should be released; written statements, or conclusions of any kind, could not be given because he didn't want to discuss certain problems connected with the samples' origin.

III - RADIATION TESTS -

The magnesium samples were tested with radiation-detection instruments. A Geiger counter and an Atomic Scaler were used, but nothing out of the ordinary was observed. No abnormal amount of radiation was detected in the magnesium samples.

IV - SPECIFIC GRAVITY DETERMINATION -

The relative density of the magnesium sample (expressed in terms of water at 4° C) was measured at the Laboratory of Crystallography. The determinations were conducted by chemist A. Batista. The method used was the classical procedure involving two weightings, and the relative density of the metal being determined by a simple formula (the weight of the specimen in air, divided by the loss of weight when suspended in water). A Jolly balance of the type used by mineralogists was employed.

Previous studies suggested that large pieces of the metal should not be used. Their surfaces were covered with magnesium hydroxide, a denser material; areas within the crystalline metal with inclusions of this material were also observed. One of the two remaining "fragments" (sample 2), for example, evidently contained more hydroxide inclusions than the other one (sample 3) — but the appearance of both samples, as seen in Figs. 1.A and 1.B., indicated that their relative densities would not correspond to the values predicted for magnesium.

In fact, they would represent only the average densities of samples containing unknown amounts of a denser material. To solve the problem, chemist Batista selected a small metallic chip taken from the center of the divided "fragment" (sample 1) for the density determination; this specimen was carefully polished until the silvery-white surface of pure magnesium showed no trace of hydroxide, under microscopic examination. Such a sample should have a density of about 1.741 but a significantly higher density was found. The carefully measured density of this magnesium sample was 1.866. The procedure was repeated three times with a microbalance and the same value was found every time. How to explain this discrepancy?

Three possibilities must be considered: (1). A hitherto-unknown close-packed modification of ordinary magnesium. It was not the case, because X-ray diffraction had identified the ordinary crystal structure of that metal (close-packed hexagonal) in the sample.

(2). An inclusion of a denser constituent in the sample.

(3). An unusual distribution of the three stable, natural isotopes that make up terrestrial magnesium, i.e., a different isotopic constitution in the magnesium of the samples.

Correct interpretation of the available data suggests that possibility (2). is the most plausible explanation. It is quite possible that a small inclusion of hydroxide was still present in the specimen (this is rendered plausible by the X-ray diffraction analysis). In such a case, the density measurements give no ground for belief in an unusual isotopic ratio. On the other hand, the powder diffraction pattern showed that hydroxide was mixed with the pure metal in very small amounts — too small, apparently, to explain the high density found. This discrepancy can be resolved only with careful determinations using several metallic chips taken from the samples. As it is evident that the hydroxide cannot be evenly distributed through the whole metallic mass, tests with different samples will show different densities. If any of the density measurements to be made corresponds to the expected value for terrestrial magnesium, then the problem is solved. But if any discrepancy remains — even a small one — then a mass spectrographic analysis is indicated, to study the isotopic constitution of the magnesium samples. The reasons will be discussed in another portion of this report.

DISCUSSION

Ever since UFOs began to be sighted in the Earth's atmosphere, the usual comment of scientists requested to make an evaluation of UFO reports and give a sincere opinion was that they lacked the type of data " you could get in yours hands." In fact, even in the "best" cases, the investigators had to rely upon what someone had seen. If we had even one piece of information substantiated by some kind of physical evidence or recorded proof, it is evident that the situation would be changed — i.e., we would be qualified to give a final yes or no to the UFO problem.

Some "fragments" claimed to have originated in the explosion of a "flying disc" over the sea, close to a beach in the region of Ubatuba, Sao Paulo State, Brazil, early in September 1957, eventually came into my possession. They were turned over to scientists at a Federal Laboratory for analysis. The investigation revealed that the material was pure magnesium, with no trace element. The only "impurity" detected was magnesium hydroxide, the dry, white powdery substance which formed an adherent layer on the surface of the material. It was not in the original metal, appearing as an effect of the fall of the magnesium fragments at ignition temperature into the sea.

The magnesium in the samples analyzed, which was absolutely pure in the spectrographic sense, represents something outside the range of present-day technological developments of earth science. In fact, the metal was of such a fantastic purity that even to see it symbolized on paper is unbeliavable. Even the infinitesimal quantities of "trace" elements usually detected by spectrographic analysis — traces so small that could not possibly be detected by any other analytical method — were not found. Thus, the magnesium in the samples was absolutely pure in the spectrographic sense — with a percentage of 100 per cent. X-Ray Spectrometry and X-Ray Diffractometry by the Powder method confirmed the results of the spectrographic analyses — the metal was pure magnesium. Again, no impurity was detected introducing irregularities in its crystal lattice. The presence of any impurity, of any interstitial atoms, would change the regularity of the crystal lattice, thus causing crystal imperfections that would be revealed by the X-ray method. Therefore, on the basis of the chemical analyses already reported and documented here, the conclusion is that the magnesium in the samples is of absolute purity — in the sense that any other possible constituents which could be present, would be present in such an infinitesimal amount as to be beyond the reach of any known method of chemical analysis.

Now, we really know very little about metals that are completely free of impurities and imperfections, simply because they are never found in nature and, in most cases, cannot

be prepared in the laboratory. It is not too hard to refine a metal to 99.99-per cent purity, which means there is something else beside the metal present to the extent of one part in 10,000 — but once we get beyond this point the going gets rough. For every 9 we stick on behind the decimal point after the first two 9's, the cost increases ten-fold, sometimes 100-fold. The reason for this is that involved, delicate and time-consuming crystallization operations are required, so that the final product becomes more precious than gold.

To study the properties of absolutely pure metals the first problem is then to secure them. As a matter of fact, the task seemed hopeless for any metal until seven years ago, when the American metallurgist Walter Pfann invented the zone-refining process, which promises to be one of the outstanding developments in the story of metallurgist's efforts to produce "super-pure" metals. With this method, it has been possible to produce germanium and molybdenum (also iron and titanium, according to some sources of information) of almost absolute purity. However, even with this process, everything has to be done piecemeal: metals cannot be purified continuously. This is the one great drawback to really large-scale production of pure metals. Such a drawback seems now to have been demolished by a new development announced by Dr. W. Pfann four years ago. His new invention, based on the zone-refining method which is called "continuous multi-stage zone-refining", will make it possible to get pure metal in a continuous flow.

Such is the situation concerning the last developments in the field of "super-pure" metals. A few ones can already be refined to approach absolute purity. But the problem still remains unsolved for a number of other metals — because of technical difficulties not yet solved. Magnesium is included in this last group. In other words, to produce magnesium of absolute purity would be an impossible task — outside the range of present-day technical developments. We can come close to it, but getting rid of the last bit of impurity is TRULY IMPOSSIBLE, even in the laboratory. If this postulation is correct, then the magnesium in the samples analyzed could not have been produced here, or recovered in the explosion of a man-made missile or vehicle. It is then of interest to discuss the matter with more detail, to get indirect and direct support of such a postulation.

Magnesium occurs abundantly on Earth but never in the pure state — always in combination. The meteorites that reach Earth, almost entirely composed of common silicates and nickel-iron, may contain magnesium but always in combination (magnesium oxides, silicates, etc) — never in the pure state. The production of metallic magnesium requires special extraction and refining methods. One of the most widely used is the process of Electrolytic reduction of magnesium chloride derived from sea water, natural brines, potash waste liquors, dolomite and magnesite. Thermal reduction processes are also available. They are of two types, one using

carbon (the Hansgirg process), the other using ferrosilicon (the Pidgeon process), for the reduction of magnesium oxide derived from magnesite, dolomite, or sea water.

Refined commercial magnesium of a purity of 99.80% Mg (Pure magnesium. ASTM number: B 92-45) can be produced by any of these methods, being available in the form of ingots, powder, ribbon, wire, and extruded and rolled strip. Impurities such as iron, nickel and copper have definite tolerance limits because the quantity and state of these impurities determine the resistence of the metal to corrosion. Some elements are not harmful in large proportions, but others are detrimental even when present in minute amounts. Calcium is usually present in very small quantities, chiefly in solid solution; if present in amounts greater than approximately 0.1%, calcium occurs as Mg_2Ca. It is not harmful and, in some magnesium alloys (M1 and AZ31X), it is added to improve certain characteristics as the grain size of the ingot, rolling properties and ductility. Excessive amounts, however, are considered detrimental to welding characteristics in some alloys.

In common with aluminium and many other metals, magnesium is not used commercially without alloying. Manganese,zinc, zirconium and aluminium are the chief alloying components of magnesium alloys. Magnesium-cerium and magnesium-thorium alloys are more recent developments in the field.

Silicon is the impurity usually picked up in ordinary foundry operations and occurs generally as Mg_2Si. If present in amounts of 0.5% or more, it changes the regularity in the crystal lattice causing defects in the magnesium crystals.

The presence of even a few hundredths per cent of manganese greatly increases the tolerance limit for iron (which is 0.017% for pure magnesium), and also for nickel.

Composition limits for commercially pure magnesium (ASTM B 92-45 for ingot and stick)(2):

" Pure magnesium sheet, wire, extrusions, ribbon, and ingot and stick for remelting: 99.80% Mg min; impurities (max), 0.02% Cu, 0.001% Ni, 0.20% total of Al, Cu, Fe, Mn, Ni, and Si.

" Powder, Grade C: 96% Mg min; impurities (max), metallic Fe 0.05%, insoluble residue 0.25%, Si 0.10%, grease and oil 0.020%, alloyed iron and aluminum as oxides 0.40%. "

It is evident, at this point, that the quantities of these impurities which are found in commercially pure magnesium vary according to sources of production and methods employed. In any case, however, they are always present — even in the composition of the purest commercial magnesium available to the consumer. In such a case, it can be concluded that no commercially pure magnesium exists with a composition at all like that of the samples analyzed.

(2) - Townsend, R. A.: Properties of Magnesium and Magnesium Alloys. Metals Handbook,

To complete the investigation on this important point, I decided to test the accuracy of the spectrograph used for the analyses, to detect these impurities, when present in the amounts found in commercially pure magnesium. I tried to obtain typical samples of this metal, of commercial origin, for that purpose. They were not available because the metal is not produced in Brazil, except in powdery or granular form. The tests were then made using chempur magnesium salts, and samples of commercially pure tin and lead. All elements whose presence was predicted in each sample, even the so-called "trace" elements, were detected in spectrograms made with the same Hilger Spectrograph used for the magnesium samples. The investigation, made by chemist E. Teixeira, confirmed the high precision and accuracy of the instrument. It also discarded the possibility of other possible constituents which could escape detection. On the basis of these studies, it is evident that the person who supplied the samples could not obtain them from any source available. Therefore, the story connected with their origin must be true. In such a case, the evidence is enough to prove that UFOs are real objects, and that one of them really exploded over the Ubatuba region, as reported by the witnesses.

Pure magnesium (99.80% Mg) still can be refined to a higher degree of purity (99.9% But the process involves such complex and time-consuming operations that the final product becomes more costly than gold. It is not available to the consumer. Besides, it cannot be prepared in scale large enough TO BE OF INDUSTRIAL APPLICATION. It is made only for special uses. For example, to be employed as "standard of purity," or for research purposes on the understanding of the fundamental properties of metals. However, the purest magnesium ever produced still has impurities that can be detected in the spectrographic analysis.

The ASTM standard of purity for magnesium (ASTM 4-0770) (3) shows, in the spectrographic analysis, the following impurities:

" Ca<0.1%; and traces of Al, Cu, Fe, and Si."

This is the purest magnesium that can be produced by present-day processing methods and refining technologies of terrestrial metallurgy.

The conclusion is that the magnesium in the samples analyzed, which was absolutely pure in the spectrographic sense, is better in quality than the purest magnesium refined on this planet; it represents something outside the range of present-day technological developments of earth science. On the basis of this evidence, it is highly probable that the metallic chunks picked up on the beach near Ubatuba, Sao Paulo State, Brazil, are extraterrestrial in origin. This is indeed an extremely interesting and truly incredible conclusion. But, on the basis of the findings of the chemical analyses presented, there is no other alternative.

(3) - Ref. Swanson and Tatge, J6 Fell Reports, NBS 1951.

As staggering as the implications may be, this appears to be the only acceptable explanation. Therefore, the magnesium samples analyzed must represent "physical evidence" of the reality and extraterrestrial origin of the UFO destroyed in an explosion over the Ubatuba region. They are, in fact, "fragments" of an extraterrestrial vehicle which met with disaster in the Earth's atmosphere, as reported by human beings who witnessed the catastrophe. The gratifying aspect of this case, however, is that we do not have to depend on the testimony of witnesses to establish the reality of the incident for THE MOST ADVANCED LABORATORY TESTS INDICATE THAT THE FRAGMENTS RECOVERED COULD NOT HAVE BEEN PRODUCED THROUGH THE APPLICATION OF ANY KNOWN TERRESTRIAL TECHNIQUES. Further investigation on the incident will be necessary, of course, but only to complete the information already obtained and, if possible, to get more samples of the material for additional examinations.

The writer had in its possession three fragments of the "flying disc." Sample 1 was used for the chemical analyses made in Brazil. Sample 2 was divided and a large piece, roughly a rectangular prism approximately 1.2x0.7x0.7 centimeters, was sent to Coral E. Lorenzen, Director, Aerial Phenomena Research Organization, Alamogordo, New Mexico. This sample can be used for other analyses, if necessary. However, if other tests are probably needed for a critical evaluation of the Brazilian analyses, special precautions must be taken from a technical viewpoint. The reasons are obvious. It is far more difficult to prove the "absolute purity" of a metallic sample than to show the presence of "impurities." Thus, spectroscopic tests cannot be accepted because they are based on the visual impression of the technician doing the test — they cannot be rechecked by other observers. Spectrographic tests done in a routine manner, using standard electrodes and making an exposure of fixed length, cannot be accepted, too. A spectrum must be run on the electrodes, for reference; possible impurities in the electrodes, in the carbon rods used as electrodes (such as traces of Mn, Fe, Si and Ti) sometimes appear as contaminants; they cannot be subtracted out on the basis of a standard assumption of purity, i.e., assuming that all standard electrodes have the same impurity content. Many variables have to be controlled such as atmospheric contaminents, dirty electrodes, using different electrodes, using different excitations techniques, etc., These are some of the correct measures that must be taken to avoid mistakes, mostly in a case like this, in which a claim of "absolute purity" was established on the basis of previous chemical examinations. What we need is a true scientific research, not a routine examination of the samples. Incidentally, sample 2 was not analyzed in Brazil but there is no logical reason to suspect that it is less pure than the other — they are similar in appearance and came from the same object.

Density measurements of magnesium chips taken from sample 2 must be made to resolve

the discrepancy represented by the high density found in previous tests. If any discrepancy still remains a mass spectrographic analysis is indicated, to study the isotopic constitutio of the magnesium in the samples.

Magnesium has five isotopes, but only three are stable; the two others are unstabl having a very short half-life. It is a striking fact that, with few exceptions, the relative abundance of the isotopes for each element is the same once and for all. The exceptions are the elements Pb, He, C, O, N and S. Apart from these minor exceptions, it appears that in th early geological period in which minerals were formed, a certain isotopic constitution preva ed all over the whole material now accessible to our investigation. Figure 5.A. shows the isotopic constitution of terrestrial magnesium:

- Fig. 5.A.-

ISOTOPE	% Natural Abundance	Half-life	Atomic Mass
Mg^{23}		11.9 sec.	
Mg^{24}	78.6		23.99189
Mg^{25}	10.1		24.99277
Mg^{26}	11.3		25.99062
Mg^{27}		9.6 m.	

A higher density might indicate a different isotopic constitution in the magnesium of the samples, if the possibility of a small inclusion of hydroxide is excluded after a care ful evaluation. An unusual isotopic distribution -- probably a preeminence of the heavier isotopes 25 and 26 -- would represent absolute proof of the extraterrestrial origin of the metal, in the writer's opinion.

Are the relative abundances of the isotopes of each element characteristic only for the earth? We don't know yet. The little material we have, derived from the investigation of meteorites (which presumably are members of our solar system, too), shows they present the same relative abundance as the elements known in the laboratory. If this could be proved for all the planets in our solar system, and for planets in other solar systems, the possibility of metals with unusual isotopic constitution could not be discussed. As we don't know yet, we must be prepared to consider it in this case, at least as an interesting theoretical possil ility. For technical reasons, this study was not made in Brazil. A mass spectrographic analysi can solve the problem. Or perhaps the isotopes can be identified by their microwave spectra; if so, microwave spectroscopy might serve as a quick means of measuring how much of what kind of isotope is present, to show if the magnesium is a naturally or artificially mixed

COMMENTS

The available evidence seems good enough to establish that the magnesium fragments were recovered from the explosion of an aerial object of artificial origin; and that this disc-shaped object was not a man-made missile, artificial satellite or remote-controlled device -- but an aerial machine of extraterrestrial origin. The question of the place, means, and purpose of original fabrication cannot be solved with the evidence at hand. Yet a few deductions can be attempted to explain the mystery of the UFO's sudden explosion and some other important questions connected with the Ubatuba incident itself. They are listed in the items below.

1 -- The lack of physical evidence -- such as crashed UFOs -- had been accepted as the best argument against their reality. In fact, it was difficult to admit the existence of a flying machine so far advanced as to have reduced the probability of mechanical failure to near zero. Even believing that UFOs utilized a principle of flight unknown to us. The Ubatuba incident, however, established the fact that these alien craft are not free of the failure factor -- i.e., that they can be destroyed by unexpected failure of their flight mechanism as any ordinary aircraft. There is yet an important difference to be emphasized. UFOs never crash, like ordinary airplanes, possibly because of the material they are made up plus peculiar characteristics of the accident itself. The Ubatuba incident suggests that the effect of a mechanical failure is such that, in a split second, the UFO explodes with prodigious kinetic force: there is a vivid flash followed, in a few seconds, by disintegration and thermic volatilization -- and the object vanishes in a shower of fiery sparks. As a result, no fragments or parts of the UFO would be found in most cases, when an accident is involved, chiefly if the explosion occurs high in the sky, because they would be completely burned into cinders long before reaching the ground. In the Ubatuba case, two fortunate circumstances were present, which caused a change in the sequence of events described above. First, the disc-shaped UFO was very low in the sky at the moment of the accident. Second, the explosion was over the sea, yet close enough to the seashore to permit recovery of fragments dropped into shallow water. If the burning metallic debris reached the ground, not the sea, it is almost certain that they would be entirely consumed by the fire. As it happened, the magnesium fire was smothered; the water quenched the burning and allowed recovery of "physical evidence."

2 -- There are, or were, two well-known uses of magnesium that unfortunately convey a wrong impression with regard to inflammability. At one time magnesium was only known to the general public as the powder or ribbon, used by photographers to produce a brilliant flash of

light. More recently the magnesium incendiary bomb has apparently confirmed the popular idea of extreme inflammability. Both the photographer's ribbon and fire bomb are special cases and must not be taken as indicating the properties to be expected in engineering applications of magnesium. Magnesium powder and ribbon burn easily because in a free atmosphere the temperature may be quickly raised to a temperature well above that used for normal melting operations in the foundry. Normally the ignition of magnesium depends upon the mass. Fine powder burns readily; components of normal masses as used in engineering cannot be ignited by any normal accidental method. The conclusion is that, in the Ubatuba incident, the explosion created intense heat sufficient to melt the magnesium container (the UFO's shell) and then to ignite the molten fragments originated in the object's disintegration. On the other hand, it is true that water cannot be used to extinguish a magnesium fire because usually it will not put it out. Burning magnesium uses oxygen from outside and, at the high temperature of this reaction, it will burn also in the oxygen of the water, setting the hydrogen free.

There is, however, one exception to this general rule which explains the Ubatuba case. In fact, it is possible to stop the reaction by supplying a great mass of cold water, suddenly, thus taking away the heat more rapidly than it is being produced. When this happens, we may find a certain amount of magnesium hydroxide on the surface of the metal (instead of the oxide) which acts protectively. There was magnesium hydroxide in the Ubatuba's samples and no oxide was found. This evidence shows that the UFO's metallic debris were still at ignition temperature when they reached the sea waters.

There is nothing theoretical or imaginary in all this. The deductions are inherent to the evidence itself. Such a evidence gives us a clear picture of what happens with UFOs of the type seen over Ubatuba region when their flight mechanism is suddenly put out of operation by an unexpected engine failure. It suggests an explanation for the lack of "physical evidence" in similar cases reported -- and explains why this "physical evidence" was present in the Ubatuba case.

3 — Magnesium is the lightest structural metal. Its extreme lightness in conjunction with good mechanical properties explain the ever increasing use of magnesium alloys in the aircraft industry. The more recent application was the manufacture of artificial satellites. Sputnik I was made up of a magnesium-aluminium alloy. The Vanguard's shell was made with magnesium coated inside and out with gold (.0005-inch thick), and covered on the outside with layers of chromium, silicon monoxide, aluminum and silicon monoxide (total thickness of the multilayered shell: 1/33 inch). The gold coating and outer layers were added because magnesium cannot maintain the temperatures needed for the proper functioning of instruments inside the satellite. Its high thermal conductivity dissipates heat rapidly.

Pure magnesium, on the other hand, has low structural strength and is not used in aircraft or missiles. By similar arguments, it could not have been expected as the chief constituent in the manufacture of an interplanetary vehicle of another culture. In fact, pure magnesium is of no conceivable use for mechanical purposes in competition with other materials available — at least apparently. In spite of this, the evidence available in the Ubatuba case showed that"flying discs" (at least those of the type involved in the explosion) are made with magnesium of very unusual purity. Metals of other kinds possibly existed inside that UFO, but were not found. The small magnesium pieces picked up near the beach apparently were disrupted from the object's shell. They suggest that shell was made with magnesium of absolute purity — i.e., with a material of low structural strength. How to explain this fact? We don't know yet. However, the intrinsic properties of absolutely pure metals are not known. More and more it is being realized in chemistry and metallurgy today that trace elements have enormously potent effects. For instance, iron that is really pure has a strength 100 times as great as commercially pure iron. Titanium, which is almost as strong as structural steel and as light as aluminum, fails miserably if it is contaminated with as little as .02% of hydrogen. Accordingly, absolutely pure magnesium with perhaps undreamed of properties, can be perhaps the metal of the future. Maybe some day we shall be privileged to study its properties. Then we will know why it is used in "flying discs."

Another possibility, if the extreme purity of the metal had no special purpose but only expressed the advanced technology used in its production, is that the UFO of Ubatuba was not manned. In fact, it could be a small, automatic, remote-controlled device launched by spacecraft in the Earth's atmosphere to pick up scientific data. Several of these objects, containing scanning instruments, might be released from the same craft and controlled from a distance. In such a case, extreme lightness would be far more important than structural strength. Our own artificial satellites show it clearly....

4 — To ignite magnesium, it is first necessary for the metal to reach the melting point — 650° C (1202 F). In the Ubatuba incident, this high temperature was reached instantly at the moment the UFO exploded. "It disintegrated into thousands of fragments," reported the witness, " which fell sparkling with magnificent brightness, looking like fireworks despite the time of the accident (at noon)." This is a perfect and precise description of a magnesium fire, of burning magnesium fragments with their brilliant actinic light. Such a report gives us a clear idea about the amount of thermic energy released in the explosion. Certainly it was not a common explosion.

The mystery of that sudden explosion which disintegrated instantly a metallic object into thousands of fiery fragments, with such a terrific kinetic force, probably will never be

solved. It could be produced, of course, by the release of some self-destroying mechanism, set to avoid a crash of an almost intact machine in our hands, thus giving us the chance to learn its secrets. There is also the possibility of an atomic explosion. We have some evidence showing that UFOs are powerful radioactive sources (4), at least in certain cases. The Campinas' incident (5) might indicate that they use atomic engines of some sort. These engines might blow up by accident. But we would expect the debris of the UFO to be contaminated, highly radioactive. However, a Geiger counter and an Atomic scaler were utilized to determine whether the magnesium fragments registered any extraordinary amount of radiation and the results were negative. This finding speaks strongly against the hypothesis of an atomic explosion. There is yet a third possible cause for the disaster, the most interesting possibility in this writer's opinion: that of a sudden failure in the UFO's flight mechanism. In fact, the Ubatuba incident involves a body moving at high-speed and apparently in trouble, almost crashing into the sea; an apparently controlled maneuver to avoid the crash at the last moment, in which the object made a sharp turn upward and climbed up on a fantastic impulse — and then the explosion. This sequence of events suggests that the high-speed maneuver was fatal for the UFO. It seems that its propulsion system, already too much overloaded, was unable to stand the tremendous strain brought by that sudden reversal of course and ceased to operate This sudden failure in the UFO's flight mechanism was apparently the origin of the explosion. Why?

Recent evidence (two incidents in France: at Vins-sur-Caramy on April 14, 1957; and at Palalda, near Montluçon, just eight days later) strongly suggests that UFOs are capable of creating electric and magnetic fields of extreme intensity, fields so powerful that iron objects eventually placed inside them acquired long-lasting magnetic properties (6). Fields of such a magnitude must be evidently connected with the UFO's flight mechanism and possibly as a means of propulsion. No one knows how they are utilized. Many scientists have rejected the possibility that UFOs could be space ships, stating that any solid body moving through the Earth's atmosphere at the reported extremely high speeds would burn up due to friction. Recent experiments, however, have indicated that heated air around an aerial machine or missiles can be deflected electromagnetically. This might explain the electromagnetic fields referred above. On the other side, other scientists have questioned the so-called means of propulsion and the reported sharp turns made by UFO's (as the one reported in the Ubatuba case). Some scientists have claimed that such sharp turns would rule out the possibility

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(4) - Ruppelt, E. J.: The Report on Unidentified Flying Objects (Chapter 15th), Doubleday & Co., Inc. Garden City, N. Y., 1956.

(5) - Fontes, O. F. : "We Have Visitors from Outer Space", The A.P.R.O. Bulletin, July, 1957.

(6) - Michel, A. : Flying Saucers and the Straight-Line Mystery (Part 5) [illegible]

of UFO's being piloted craft, or even aerial machines of any kind.

It has been suggested that an artificial gravity field would solve those problems. At this point, it is interesting to note that two physicists, at a recent meeting of the American Physical Society, claimed to have produced a measurable gravity field with experiments on a device consisting of electro-magnets mounted on a rotating disc (7). If such experiments are confirmed, we may be on the way toward duplicating the performances of the UFOs. Anyway, the very strong electromagnetic fields detected in connection with the UFOs seem somehow related with an artificial gravity effect of some sort. Unfortunately, we don't know yet what gravity is. We can describe what it does but we have not the foggiest notion what it is. The strong-interactions (electomagnetic forces and nuclear forces) are certainly fascinating — but it is the ultrafeeble interactions that have us Earthbound, Gravity and inertia. The science of gravitics, electrogravitics and electromagnetism is still groping in the dark, we are just beginning to study the complex problems involved. However, if "force fields" can be used to neutralize the gravitational pull of the Earth and to propel a vehicle to reach the planets — then such fields could act also on the air molecules surrounding a fast-moving UFO flying in the dense lower levels of the atmosphere, dragging the adjacent molecules of air along with the object, at speeds varying with their proximity to the object' surface. Such an effect could protect the UFO against overheating even at enormous speeds. In fact, the heat produced by friction, instead of being concentrated on the surface of the UFO, would be dissipated in this thick layer of air carried along with it. Now, what would happen if the mechanism creating the "force field" failed unexpectedly? The "force field" would evidently vanish instantly. If the "force field" collapses, the surrounding air ceasing to be carried along, (a) that thick layer of air around the UFO disappears too. If the UFO was moving at speeds between Mach 4 and Mach 8 at that moment, (b) it continues on its course and strikes against the motionless and elastic barrier of air with tremendous kinetic force. Its equilibrium temperature changes instantly from the normal to white hot. Thermic disintegration is a matter of seconds: (c) with a vivid flash and sometimes a noise like a thunder, the craft explodes in flames or dissolves into a shower of sparks. If the speed is very high, as in the Ubatuba incident, these three stages (a, b, and c) blend into a sudden and violent explosion.

This theory that UFOs can control the so-called "boundary layer" and make it very thick and turbulent through an artificial gravity field has been suggested by Lieutenant Jean Plantier, from the French Air Force, in a recent book about UFO's propulsion system (8).

(7) - "Science Suggests Answers to UFO Performances", UFO Investigator, 1:8 (Dec.), 1958.

(8) - Plantier, J.:La Propulsion des Soucoupes Volantes par action direct sur l'atome. MAME Ed., Paris, 1958.

5 — If Plantier's theory could be tested and confirmed by experiments, it would explain how UFOs are protected against overheating even at enormous speeds. Also it would explain the mechanism of that sudden explosion destroying the UFO involved in the Ubatuba incident. To accept his hypothesis, however, it is necessary to prove by experiments that a rotating electro-magnetic field can produce a measurable gravity effect. Or that the strong-interactions — in the form of "force fields"— can somehow be used to neutralize the gravitational pull of the Earth and to propel a vehicle to reach the planets. The development of such a theo would surely require a body of data not yet available to us, that can be obtained only through long-term, continued research. At the moment, the only thing we know is that UFOs seem to be capable of creating electric and magnetic fields of high magnitude around themselves.

In this writer's opinion, these electro-magnetic fields suggest another explanation that makes unnecessary the existence of an artificial gravity field around the UFOs. In fact, recent developments in the field of hydromagnetics seem to indicate that the heating effect on the surface of a rocket or missile can be avoided by using magnetic fields. The possibility was discussed by Dr. W. F. Hilton, Chief Aerodynamicist, Armstrong-Whitworth Aircraft Co., in England, in a recent statement (9):

> " From a study of thermonuclear work on the 'pinch' effect, we decided to try the effect of magnetic fields on the hot flow from our company's shock tube. The basis of this interaction is the very great heating of air behind the shock wav from the front of the vehicle. This heating causes the air to become partially ionized into electrically charged particles, and these particles in rapid motion past the vehicle have the nature of an electric current. They are therefore susceptible to deflection by means of a magnet. So far our results have been very encouraging, and we have been able to provide quite definite deviations with a small electro-magnet powered by a 12 volt battery. Whether this effect will lead to a practical contribution to re-entry remains to be established. " UNQUOTE.

In a recent report to the American Rocket Society (7), Dr. Russell M. Kulsrud (Princeton University physicist) also stated that the new field of "hydromagnetics" (formerly called magnetohydrodynamics) might help solve the missile re-entry problem. In nuclear fusion devices (H-bombs for instance) magnetic fields are used to keep electrified gases away from the walls of a container long enough for the nuclear reaction to take place. The same principle, he said, might be used to deflect hot gases generated by devices plunging into the atmosphere. Dr. Kulsr ud, who is working on a plasma-physics study called Project Matterhorn, at Princeton, also said that the science-fiction concept of using invisible "force fields" to repel incoming objects was becoming a reality in hydromagnetics.

Hydromagnetics deals with the reaction of "plasma" fluids to high magnetic fields — — strong enough to control charged particles moving in a "plasma" -- and smaller electric fiel

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(9) - UFO Investigator, 1:1 (August-September), 1958.

In the so-called "pinch effect", the flow of an electric current through a gas generates a strong magnetic field which at once contains the gas and brings it up to high temperature by compressing, that is, pinching it. In the writer's opinion, ionization and magnetism combine to produce a hydromagnetic effect on the air in rapid motion around a fast-moving UFO — i.e., the energized ions, atoms (or positively charged nuclei) and free electrons in the air are contained in a magnetic field. Thus contained in the magnetic field, the ionized air will not touch the surface of the object. Yet, in the UFO's particular case, what is necessary is a magnetic field produced independently of the electric current that heats the gas in the pinch effect (a pinch-effect current is not needed here because the very great heating of air behind the shock wave already made it partially ionized into electrically charged particles, as said before). This can be obtained via an externally applied, rapidly pulsating magnetic field. The charged particles moving across this field will experience a deflecting force and proceed to gyrate in circles about the lines of magnetic force. An electric current will flow through the air along the magnetic surfaces. The power dissipated by the resistance of the gas will go into ionizing and heating the air, as well as into producing some ultraviolet and visible radiation. This might be called "ohmic heating," because it is the ohmic resistance of the gas that generates the heat on passage of the current. Unlike a pinch-effect current, the ohmic-heating current will not produce any contraction or compression of the ionized gas. As a result, the strong magnetic field around the UFO will hold the gas firmly in place and almost constant in volume. Such a magnetic field must be "force-free", i.e., capable of mantaining its form through a balance of purely magnetic forces. It is already proved that a force-free magnetic field is possible in a toroidal shape.

In fact, there are magnetic fields (according to the German astrophysicists A. Schluter and R. Lust) that possess certain special field configurations which are "force-free" in the sense that they do not tend to expand of distort their shape. If we assume a set of wires wound into a metallic object in such a manner as to produce a three-dimensional magnetic field, the object would have a longitudinal field into the coil (inside its walls), seeking to expand, and a circular field running around it, seeking to contract. In short, these fields would balance so that no inward or outward force exists. The main trouble would come at the end of the system, for the compensation would break down there and the force-free configuration consequently disturbed. A way out is suggested by the torus, or doughnut, a system without end.

It seems obvious that in a disc or saucer-shaped object the "coil" bends in a circle, to form a closed but endless system. In the resulting toroidal, or doughnut-shaped, magnetic field the lines of force become circles and the path of each charged particle is a helix. Yet, such a toroidal field is not stable enough due to the effect of particle drift. In fact,

as a result of curvature, the strength of the magnetic field is greater near the inside than it is near the outside. This inhomogeneity of the field alters the helical path of charged particles. The result is that the charged particles drift across the field, the positively charged ones collecting at the top of the tubular field and the electrons at the botton. This drift is bad enough for itself, but its indirect effect will be catastrophic. The resulting separation of electric charges produces a large electric field, which will disrupt the particle paths completely, throwing the entire gas into the surface of the UFO. This is due to the fact that a steady electric field imposed across a magnetic field produces no current at all in a fully ionized gas, but drives the gas particles in a direction at right angles to both the electric and magnetic fields. As a consequence, the UFO would be destroyed in the process.

Yet there is a simple solution for this drift of charged particles across a toroidal magnetic field. By one means or another the magnetic field can be twisted around its circular axis, giving the lines of force a helical form like the strands of a rope. In this twisted toroidal field the effect of particle drift is much reduced. Oppositely charged particles still will show some tendency to drift apart, with an accompanying separation of charges, but now the charges can leak back along the lines of force. Any difference in electric charge along a line of force will be thus eliminated, and a steady confinement of the ionized air now becomes possible. The necessary twist can be imposed on a toroidal field in a number of ways. Passing a electric current along the lines of magnetic force in a torus will do it, but such a current would require pulsing every few seconds. Another way is the method in which the toroidal field is twisted by interaction with an additional transverse magnetic field (generated by a set of helical windings in which the current flows in opposite directions in adjacent groups of wires).

On the basis of the data discussed above, it is the opinion of this writer that hydromagnetics could explain the UFO's apparent immunity to air friction and suggest perhaps a possible power source. It is postulated that ionization and magnetism produce a hydromagnetic effect on the air surrounding a high-speed UFO which avoids any contact between the gas and the object's surface. There is first the very great heating of air behind the shock wave from the front of the vehicle. This heating causes the air to become partially ionized into electrically charged particles, and these particles in rapid motion past the vehicle have the nature of an electric current. The interaction of a independently produced magnetic field which is possibly created via a externally applied, rapidly pulsating magnetic field, holds the electrified particles in circular orbits. This force-free field is probably a twisted toroidal magnetic field (or a special field configuration with similar properties). The deflected particles are kept away from the UFO's surface; the charged particles and atoms collide only with each other and the plasma becomes fully ionized. A circular electric current flows into the doughnut-shap-

ed plasmoid thus formed around the object. This plasmoid acts as a "cushion" of high magnetic--field pressure between the object and the surrounding atmosphere (like an invisible "force field"),but does not touch the surface of the UFO — which moves in a kind of "aerodynamical vacuum inside it. The strong force-free, rotating magnetic field holds the plasmoid firmly in place and constant (or almost so) in volume around the object. The ohmic-heating current (unlik the pinch-effect current of thermonuclear experiments) produces no contraction or compression of the ionized gas confined into the externally applied magnetic field around the UFO. It is obvious, however, that the air does not remain steady and motionless during ohmic heating. In fact, the ionized gas is expected to develop violent activity during the process. The object's own motion plus the effects of electric and magnetic forces involved introduce complications which make the activity quite different from ordinary turbulence. Ultraviolet and visible radiation are certainly produced as a side-effect. Besides, the "cooperative activity" of charged particles in the heated and ionized gas can produce many other effects, some of them not yet understood.... For instance, the production of radio-noise bursts similar to those observed from the sun. Disturbances of the "hydromagnetic" type can also be expected, as well as the appearance of "runaway" electrons — that cannot be no longer confined and strike the object, producing intense X-rays (this tendency is probably reduced with a twisted field).

It seems reasonable to expect that a high magnetic field of the kind discussed above — strong enough to form and maintain a plasmoid around a fast-moving UFO through a balance of purely magnetic actions — would protect UFOs against air friction at any speed, thus avoiding any heating effect. Besides, it seems that the effects listed above correspond with many of the unexplained phenomena reported in connection with the UFOs. But magnetic fields are of course invisible and lines of force are purely imaginary constructs. How can we "see" them on the UFOs? A way out is suggested by the Zeeman effect — which certainly would be detected in the spectrum of light emitted from UFOs at night. Anyway, the empirical evidence available seems enough to indicate a careful research of the theory discussed. Fields of the magnitude we have been discussing are probably strong enough to dominate the motion of charged particles within atoms, to cause some crystals to contract, to make a conducting metal extremely resistant to electrical current or opaque to infrared radiation — and perhaps to produce a measurable "gravity field" effect,* too. Who knows?

In the case of a UFO moving at a low speed, or stopped in mid-air, the heating of air particles is possibly not enough to generate a plasmoid around it — only the magnetic field would exist. If necessary, however, magnetically confined plasmas might be generated by a rotating part in the object (a spinning ring for instance), by rotation of the object itself around its axis — or with the help of special "plasma jets" on the object firing doughnut-shaped

bursts of plasma. In the near-vacuum outside the atmosphere these plasma jets might operate also as a possible propulsion source. On the other hand, it seems evident that the sudden collapse of the force-free field and plasmoid, if the object is moving at high speed in the dense lower levels of the atmosphere, would result in its ~~thermical~~ THERMAL disintegration in a matter of seconds. The mechanism would be similar to the one already discussed in connection with Plantier's theory (item 4). Such a mechanism could certainly explain the mystery of the sudden explosion which destroyed the UFO involved in the Ubatuba incident.

6 -- We are already beginning to probe the new frontier of the so-called "thermal barrier," as our planes approach thermantic (from Mach 2 to Mach 4) and superthermantic (from Mach 4 to Mach 8 [speeds]). There is also the missile and satellite re-entry problem. In the thermantic region (1.325 to 2.650 mph.), stagnation temperatures (i.e., air's original temperature plus the heating caused by friction with the moving surface of a plane) range from 250° to 1500° F. They vary from 1200° to 6300° F. or more in the superthermantic region. However, the picture is much less severe in relation to equilibrium temperatures (the ones in the metal on the surface of the airplane). In the thermantic region, for instance, they get up to only 900° F. But the result, of course, is still heat, and plenty of it. At superthermantic speeds the problem becomes far more difficult. Tomorrow's airplane may glow red and give off enough heat to warm up 400 average-sized homes while reaching its equilibrium temperature at 180000 feet, at a speed of Mach 8. To solve the problems involved, we are trying an endless search for better and better heat-resistant materials and cooling systems.

On the other hand, the evidence available suggest the problem of the "thermal barrier" was already solved by the intelligences behind the UFOs. These unconventional aerial objects can move across the Earth's atmosphere at velocities between Mach 4 and Mach 8 or more — with apparent immunity to the heating produced by friction with air molecules. Are they made with heat-resistant materials better than Pyroceran or Inconel-X ? This was apparently the obvious explanation, despite the fact that the extremely high speeds reported in certain cases would be enough to burn up even the best heat-resistant material in the Universe. Cooling systems might help, of course, but they too are useless if the speeds are high enough ...

The physical evidence in the Ubatuba incident provides a different answer for the question. It indicates clearly that materials of high heat-resistance are not the key to the "thermal barrier" problem. It is obvious that an object made with magnesium (a metal of low heat-resistance) could never stand the overheating at the unbeliavable speed it was moving when first seen over the sea. The magnesium shell would lose its mechanical strength quickly and burn in a few seconds -- at speeds far below the one reported. Yet, the Ubatuba "flying disc" did not show any sign of overheating at any time before the explosion -- despite the

enormous speed it was moving when approaching the beach. This is a very important point. As no trace of any protective coating was detected in the fragments recovered, it seems evident that something invisible existed around that UFO to protect its magnesium shell against air friction. When that protection disappeared, on the other side, ~~thermical~~ THERMAL disintegration in a few seconds was the result observed.

Whether or not that something protecting the UFO against overheating at high speeds was an artificially thickened and controlled "boundary layer" (Plantier's theory), or a hydromagnetic effect producing a kind of "aerodynamical vacuum" (the writer's hypothesis), remains to be established. Anyway, the conclusion is that our present-day approach to the same problem should be carefully re-evaluated. Our endless search for better and better heat-resistant materials and cooling systems may show good results for some time yet, but it will not win for us this new frontier. A different approach should be tried for it seems that more practical and efficient solutions can be found. On the basis of the evidence available on the Ubatuba incident, it is the opinion of this writer that the key to the problem is just before our eyes -- -- every time a UFO is sighted ....

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SUMMARY

(1) - Early in September 1957, a group of observers at a beach near Ubatuba, Sao Paulo State, Brazil, watched a disc-shaped object flash down out of the sky at very high speed, toward the sea. Just as it seemed about to strike the water, it veered sharply and suddenly upward and then exploded in flames. The explosion disintegrated the unconventional aerial object into thousands of fragments, each fragment glowing brightly in the noonday light like fireworks. Most of these fragments fell far from the beach, but a number of small pieces reached shallow waters which apparently quenched the fire and allowed recovery of a large amount of the material.

One of the observers sent three of the pieces of the disc to a newspaperman, at Rio de Janeiro. Eventually they came into the possession of the writer. As their peculiar appearance suggested they might really be pieces disrupted from a larger metallic mass, or object, under the action of some force; and that they had been burned or scorched by some kind of fire, or heat — it was decided that a scientific investigation was indicated to establish the composition and possible origin of the samples.

(2) - The writer turned the fragments over to scientists at the Mineral Production Laboratory, a highly-qualified Federal Institution for the examination and analysis of mineral

substances, metallic ores, metals and alloys. A spectrographic analysis was performed by Dr. Luisa Maria A. Barbosa, chief chemist of the Spectrographic Section, revealing that the material was pure magnesium, with no trace elements. The instrument used was a large Hilger Spectrograph. Surprised by this extremely interesting and truly incredible finding, the writer requested a second analysis by the X-Ray diffraction method. It was made at the Laboratory of Crystallography at the Geology and Mineralogy Division of the National Department of Mineral Production. The man who conducted the tests was Dr. Elysiario Tavora Filho, director and chief-chemist of this research institution, a well-known scientist famous in Brazil because of his pioneer works in Crystallography. X-Ray Spectrometry and X-Ray diffraction analysis by the Powder method, using a camera of the Debye-Scherrer-Hull type, confirmed the previous result. The analyses revealed that the metal in the fragments was pure magnesium, and that the only "impurity" present was magnesium hydroxide — in the form of a dry, white powdery layer adherent on the surface of the material. It was not a constituent of the original metal, appearing as an effect of oxidation of the burning magnesium fragments in contact with water.

To re-check the results of the previous examinations, a second spectrographic analysis was made by chemist Elson Teixeira, a top-expert in the field, using the same Hilger Spectrograph. The results were the same: the magnesium in the samples was absolutely pure in the spectrographic sense — with a percentage of 100 per cent. Even the infinitesimal quantities of "trace" elements usually present in any metallic material were not detected.

A Geiger counter and an Atomic Scaler were utilized to determine whether the fragments registered any unusual amount of radiation. No abnormal amount of radiation was detected in the samples.

The relative density of the magnesium fragments was measured at the Laboratory of Crystallography. The determinations were conducted by chemist Augusto Batista, using a classical procedure. The material should have a density of about 1.741, but the density found was 1.866. On the basis of data obtained by X-ray diffraction analysis and by microscopical examination of the samples, it is quite possible that a small inclusion of magnesium hydroxide still present in the specimen was responsible for the discrepancy. If this possibility can be excluded with careful tests using different metallic chips taken from the samples, the other possible explanation involves an unusual distribution of the three natural isotopes that make up terrestrial magnesium. In such a case, a mass spectrographic analysis should be indicated.

(3) - A third spectrographic analysis was made at the ITM (Military Institute of Technology). A Brazilian Army officer requested the sample for this examination, but the writer was not informed about the findings obtained. Another metallic chip of the material was supplied to Com. J. G. Brandao, a Brazilian Navy officer who contacted the writer to make a simil-

ar request. No information was available on methods used and findings obtained.

(4) - All the results available to the writer are presented in this report -- including pictures of the fragments, the chemists' reports, plus spectrographic films and X-ray diffraction diagrams and films. Also a complete and detailed account on all facts and events related with the chemical investigation of the samples.

(5) - A careful evaluation of the results obtained in the chemical examinations and analyses was made. Correct interpretation of the available data in the light of scientific knowledge and technological evidence indicates that the observer who supplied the magnesium samples could not obtain them from any source available. On the basis of these studies, it was concluded that the story related with their origin was true. Therefore, the magnesium fragments represent "physical evidence" of the reality of disc-shaped UFOs. Such an evidence constitute scientific proof--enough to prove they are metallic object of artificial origin, and that one of them was really destroyed in an explosion over the Ubatuba region.

(6) The metallurgy and technology of magnesium production was discussed in full detail and the last developments in the field of high-purity metals were reviewed carefully. The final conclusion is that the magnesium in the fragments analyzed, which was absolutely pure in the spectrographic sense, is better in quality than the purest magnesium refined on this planet; that it represents something outside the range of present-day technological developments of earth science. Indirect and direct support of this postulation were presented and evaluated. If the postulation is correct, the conclusion is that the object involved in the Ubatuba incident could not have been a man-made device, missile, or vehicle. On the basis of this evidence, it is highly probable that the metallic fragments picked up on the beach near Ubatuba, Sao Paulo State, are extraterrestrial in origin. In other words, that they are pieces of an extraterrestrial vehicle which met with disaster in the Earth's atmosphere. Correct evaluation of the data suggests this as the only possible explanation, as staggering as the implications may be.

(7) It is believed that the chemical studies of the samples represent scientific evidence to support the validity of the story connected with their origin; and that we do not have to depend on the testimony of witnesses to establish the reality of the incident. Further investigation on the incident is still necessary, of course, but only to complete the information already obtained and — if possible — to get more samples of the material for other examinatio

(8) Comments on the mystery of the UFO's sudden explosion and other important question raised by the Ubatuba incident are also presented. The possible causes of the explosion are discussed and interpreted. The possible application of pure magnesium in the manufacture of aerial vehicles of another culture is studied. The possible consequences of mechanical failure in the

UFO's flight mechanism are analyzed from a theoretical viewpoint. On the basis of the data discussed, it seems evident that the problem of the so-called "thermal barrier" was already solved by the intelligences behind the UFOs. On the other hand, the physical evidence in the Ubatuba incident seems to indicate that materials of high heat-resistance are not the answer for the question of the UFOs apparent immunity to air friction at the very high speeds reported. It seems evident that something invisible exists around the UFOs to protect their surface against overheating at high speed. The possibility of an artificially controlled "boundary layer" is discussed. On the basis of recent development in the field of hydromagnetics, it is the opinion of the writer that a hydromagnetic effect of the plasmoid type is the most probable answer for the problem. This theory is discussed in detail and technical and scientific aspects involved are carefully analyzed. A sudden failure of such a mechanism could surely explain the explosion that destroyed the UFO involved in the Ubatuba incident, but the validity of the theory remains to be established.

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