The British Interplanetary Society

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Executive Secretary: Suszann Parry

Archaeology for Space

Wednesday 10 May 2006
Conference Room
British Interplanetary Society, London

A symposium form the British Interplanetary Society, to address a number of space-age archaeological approaches. Relates to how Earth satellites can assist in locating archaeological sites and the theoretical possibilities relating to probes and landing sites becoming "future human space archaeology".

PROGRAMME

10:00-10:05 **Welcome**

Malcolm Smith

10:05-10:35 **A Sumerian Observation of the Koefels? Impact Event**

Mark Hempsell, University of Bristol, Alan Bond, Reaction Engines Ltd

10.35-11.05 **Archaeology's Cold War Windfall - The Corona Programme and Lost Landscapes of the Near East**

Keith Challis, University of Birmingham

On the 12th August 1960 the airborne capture of 3000ft of exposed film from the return capsule of the Discoverer XIV mission signalled the first successful recovery of an object sent into space and the start of the United States satellite reconnaissance programme. The approximately 900,000 images collected between 1960 and the last Corona mission, in May 1972, proved a revolution in intelligence gathering; the Cold War arsenals of the Soviet Union and Communist China were laid bare. Since its declassification by Executive Order in 1995 the archive of high-resolution Corona satellite photography has offered archaeologists a retrospective look at the now lost landscapes of the Near East, captured on film over a decade before the first (low resolution) civilian satellite imagery.

11:05-11:15 Q & A

11.15-11.30 COFFEE

11.30-12:00 **Conserving Space Heritage: The Case of Tranquility Base**

Thomas G. Fewer.

One of the most important and spectacular events in the history of space exploration was the first Moon Landing of 1969. Safe from the ravages of erosion, agriculture, industry or the expansion of human settlement, the greatest threat to the site of this momentous event - Tranquillity Base - is likely to be from a meteor impact. However, with the advent of space tourism and commercial space travel, the site of humankind's first visit to a celestial body may come under threat of a different kind - that of souvenir hunters and miners. In this paper, the historical background to the Apollo programme is outlined and the sequence of events that made up the Apollo XI mission, which conducted the first Moon landing, is described before concluding with a consideration of the heritage conservation issues of Tranquillity Base.

12.00-12.35 **SETI - Why The Radio Silence?**

Ananda Sirisena, Symantec Corp

The reported lack of intelligent signals from outer space has been regarded as a sign that there are no advanced races out there transmitting radio. However, there may be several reasons why a radio silence may be maintained by ET.

This presentation considers the possibility: (a) that ET may manifest with energy markers and/or matter markers (b) that ET may already have visited Earth in the past and may be visiting us now.

In a free-form, “let’s think outside the box method”, this paper considers other possibilities for radio silence, as well as the subjective method employed in classical SETI. It will conclude with the results of an interview with a well-known author and space enthusiast and the somewhat puzzling logic prevailing around the issue of ET visits.

A 10-minute video will cap the presentation and lead to a forum for discussion around the need to consider signs of ET visitation from closer to home – i.e. interplanetary, as well as the universally-held view that the galaxy is “teeming with life”.

12:35-12:50 **Q&A**

12.50-14:00 Lunch

14:00-14:30 **Will ET Write or Radiate: Interstellar Messages in a Bottle**

Dr Christopher Rose, Rutgers University

We consider the energy requirements of information carriage using physical transport of inscribed matter and compare it to that using electromagnetic radiation when delivery delay beyond light transit time can be tolerated. Somewhat counter-intuitively, physical transport of inscribed matter is often *vastly* more energy efficient than electromagnetic signalling over a wide range of scenarios — from chip-to-chip computer communications to interstellar signalling. In fact, the efficiencies are so enormous that it may even be more likely for initial contact by extraterrestrial civilizations to occur using physical artifacts — essentially messages in a bottle — than via electromagnetic communication

14:30-15:00 **Detecting and Interpreting Patterns on Possible Intelligent Activity in Optical Imagery**

Mark J Carlotto

Carl Sagan (1975) proposed that deviations from thermodynamic equilibrium are a necessary (but not sufficient) condition of intelligent activity. He cited significant deviations from the blackbody radiation curve of Earth in the radio frequency portion of the electromagnetic spectrum as evidence of intelligence. This model provides detection criteria for radio SETI. Similarly, passive (electro-optical) imaging of Earth at resolutions (spatial scales) smaller than about 1 km reveals evidence of mechanical dis-equilibrium (e.g., rectilinear patterns of agriculture, road networks, etc.).

This paper develops criteria for the detection and interpretation of intelligent activity on planetary surfaces in optical imagery, which follow from Sagan’s model. A variety of processes shape planetary surfaces over a range of spatial scales. Geological processes like tectonics roughen the surface, those like erosion smooth the surface. The net result is that most planetary surfaces (Earth included) are fractal, i.e., measurements of their properties follow a power law of the form $Y = Y_0X^b$ where Y is a measurement, X is the scale of the measurement, and b is related to the fractal dimension.

Motivated by the observation that man-made activity is highly non-fractal, Stein (1985) developed a method for detecting man-made objects as deviations from a power law (fractal) model of the image intensity surface on a local basis. Carlotto and Stein (1990) applied this technique to assess the possible artificiality of certain Martian landforms. Arkhipov (2001) used fractal analysis together with other features to evaluate a number of lunar finds. Carlotto (2003) examined the correlations between geospatial anisotropies (directions of high correlation in the variogram or spatial autocorrelation function of the image), and the axis of symmetry of enigmatic landforms in the Cydonia region of Mars and showed their similarity to certain terrestrial archaeological sites. Crater and McDaniel (1999) analyzed the spatial relationships within a collection of mound-like objects, also in Cydonia.

15:00-15:30 **The Mounds of Cydonia: A Case Study for Planetary SETI**

Dr Horace Crater, University of Tennessee Space Institute

The Society for Planetary SETI Research (SPSR) has as its aim the study of features on planetary surfaces to evaluate possible signs of ET activity in the form of landscape modifications or other alterations not easily attributable to natural geological formation. In this talk we display one such study. We show that a group of twelve mound-like formations in the Cydonia area of Mars of relatively small and nearly uniform size have relative positions that repeatedly display symmetries in the apparent form of related right and isosceles triangles. For five of the mounds we display some remarkable and precise geometrical features highlighted by close connections to sequences of prime numbers. Extending the analysis to all twelve mounds we show that the frequency of appearance of these related triangles cluster sharply in density about a certain value of the angle defining those related triangles. Even though the fitting is not as precise as with the pentad of mounds, we find that on average the vertices of the triangles lie significantly closer to the measured centers of the mounds than those for fictitious mounds from a computer simulation. Our computer simulation of the surrounding features and the mound formations themselves demonstrate that the numerous examples of these symmetries, the resultant clustering about certain proportions, and the relative precision of the vertices to the mound centers are not compatible with either random placements or known geological pattern. We have thus uncovered an anomaly of number, geometry and precision. In order to give a quantitative measure of this anomalous distribution of mounds we determine the likelihood that we will make an error by rejecting the null hypothesis. This level of significance we find for our test is p~15.5 x 10-6. That is, in a million trials, the repetition of the frequency of appearance of these triangles, greater than or equal to the observed (19) in the actual data, and with the observed or greater precision, is about 15±2.5. In this computer simulation the average number of appearances is about 6, with a standard deviation of about 2. In 95% of the computer simulations, the distance of the vertices of the triangles was, on average, farther from the (fictitious) mound centers than for the case of the actual mounds. In order to assess the role of the special geometry itself as a possible source in the sharp clustering in the density of appearances of these triangles we have further examined each of 1 million randomly generated images with the same analysis techniques that we used for the actual Cydonia mounds. We discuss the results and their implications for Planetary SETI.

15.30-16.00 **Q&A**

16:00 **Closing Remarks**