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Face-Like Feature at West Candor Chasma, Mars MGS Image AB108403

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Abstract—We describe aspects of a skull-like feature found in Mars Global Surveyor (MGS) image AB108403. The skull-like feature becomes face-like when one recognizes the presence of component facial features of appropriate size and shape, features such as cheek, chin and neck. Further component features of the image including eyes, nose, and mouth combine to give the impression of a human-like face. A special analysis of the eyes is undertaken, one involving two independent eye specialists. We then undertake a critical analysis including a comparison of natural head or face-like features on earth as well as a probability analysis of the possibility that the features could have appeared randomly. Our analysis suggests that natural and/or random processes fail to provide a satisfactory explanation for its formation. Among others, we also describe a flat facial profile found in a statistical survey for other eye-like features on Mars. The Profile has an identifiable eye, nose, lips, chin, cheek, and neck. Unlike natural head-like features found on earth, which tend to be grotesque and quite angular, both the Skullface image and the Profile image have relatively smooth and proportionate facial features.

Keywords: Mars — face-like feature

Introduction

NASA scientist Tobias Owen discovered what has come to be known as the "Face on Mars" among the many images taken by one of the Viking space probes in 1976. On July 31st of that year the Public Information Office at the Jet Propulsion Laboratory (JPL) commented in a caption that, "...the picture shows eroded mesa-like landforms. The huge rock formation in the center, which resembles a human head, is formed by shadows giving the illusion of eyes, nose, and mouth" (JPL, 1976). Controversy on the accuracy of this statement has raged for over 25 years. In the meantime, the MGS spacecraft acquired new imagery of the object using its Mars Orbital Cameras (MOC). These included the April 1998 image (PIA01236), the January 2001 partially

illuminated image (M1600184), and the fully illuminated Extended Mission image (E0300824) of April 2001.

Contrary to claims of natural origins made by individual scientists at NASA (Morrison, 1998) and at JPL (Pieri, 1999), the MGS images supported the earlier claims (Carlotto, 1997) concerning the unusual symmetry of the "Face", the unusual regularity of its platform (Carlotto, 1999), and new indications of the existence of secondary facial features not seen in the Viking images but expected if the "Face" was indeed an intentional construction. Further analyses involving both statistical and newly applied image enhancement procedures that were not previously available supported the artificiality hypothesis (Van Flandern, 2002). Although appearing at first glance to be a highly eroded natural formation, analysis of the new Extended Mission image shows the object to possess a very high degree of symmetry in two directions (Carlotto, 2002). Flemming (2002) presented evidence countering recent claims of natural origins for the "Face" reported by Phillips (2002) based on the MGS laser altimeter data. Flemming's conclusions support the earlier shape-from-shading methods used by Carlotto (1988). Carlotto and others have also presented independent evidence of a statistical nature supporting the claim that certain objects on Mars are artificial (Carlotto, 1997). These features include not only the "Face" but also patterns of relative placements and alignments of various other anomalous objects. Included among these were a series of mound shaped objects, each about the size of a city block. Crater and McDaniel have shown that a pattern of repetition of the arrangement of these objects is well beyond chance (Crater, 1999). Although no claims of artificiality were made, they uncovered an unusual anomaly of a repeating geometrical pattern, certain aspects of which show a high degree of precision and mathematical elegance.

Here we limit further discussion of the evidence presented in the above articles and the continued controversy regarding the "Face". We now turn to another face-like feature we feel presents additional evidence in support for the artificial origins hypothesis. We focus on one of 78,000 MOC images posted on a web site operated by Malin Space Science Systems (MSSS), the NASA contractor responsible for operating the Mars Orbital Cameras. Taken at the north wall of West Candor Chasma, image AB108403 is available to anyone on the internet at http://www.msss.com/moc_gallery/ab1_m04/images/AB108403.html. Here we intend to describe the central and strongest of several anomalous objects found in this image.

1. Face at West Candor Chasma

Unlike the Cydonia Face, the face-like feature in the AB108403 image was not discovered by a NASA scientist. It was first brought to the attention of the public on a web site operated by Mr. Paul McLeod. Unlike the Cydonia Face, this feature is not isolated, is not lying flat, and is not directed upward.

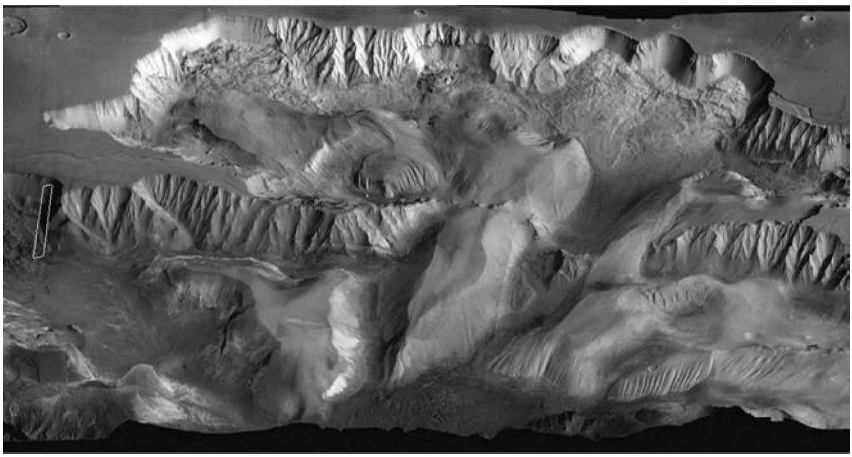

Fig. 1-a. Viking mosaic of Candor Chasma with MGS image AB108403 located left at north wall.

Instead, it is on the side of a cliff near the bottom of a large canyon. It is located near the bottom of the north wall of West Candor Chasma atop or against what appears to be the debris flow of a landslide off the chasm wall. The object may have been at one time buried but then was exposed by this landslide. The reader is invited to make his/her own conclusions by examining the magnificent Viking mosaic in Figure 1a. Figure 1b is a blow-up of the area where the 8403 image is located. We emphasize the feature, unlike the Cydonia face, is not on a flat horizontal plane. Rather, it appears to be on a sloped wall of a canyon. This would make it less likely to become covered by settling layers of dust.

Continued study of the entire 4.67 km-by-35.55 km MGS image swath, as well as corroborating Viking imagery located by Erol Torun (Figure 1c), resulted in the discovery of the feature of Figure 2. Informally it has come to be called ‘‘Skullface'' because of what appeared at first to be an abnormally large bald skull. Pictures depicting each of the observed facial features are attached toward the end of this paper, but we suggest the reader closely examine the un-annotated pictures before inspecting those labeled by the authors so that the reader may draw his/her own initial impressions.

General Outline of Skull

The top of the skull has a hemispheric shape. The skull is often the first feature noticed, the most prominent of several suggestive head and face-like features including cheek, chin, and neck. The spacecraft altitude was 1037 km while the ‘‘slant distance'', the distance between the object and the MOC, was 1214 km. This means the MGS turned from nadir to obtain the image off to

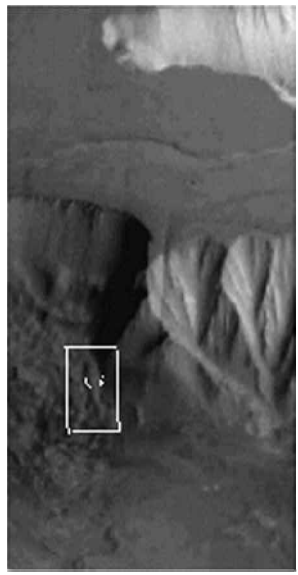

Fig. 1-b. Skullface location at north wall. Rubble at lower portion of the image suggests there may have been a landslide.

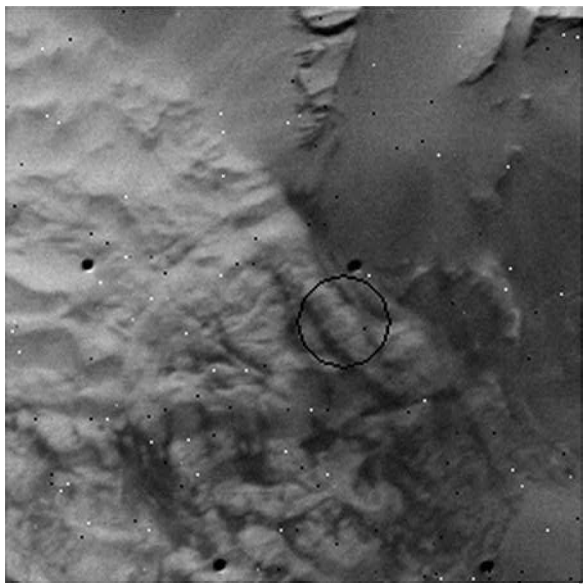

Fig. 1-c. Viking image from frame 66A24 of the Skullface area at the north wall of the chasma.

Fig. 2. Skullface. Cropping of AB108403. The image was processed by increasing contrast and brightness.

the east. This results in a certain amount of facial asymmetry. The skull appears turned approximately thirty degrees from face-on to camera in the image. In other words, although not in perfect profile, some of the left (the reader's right) side of the feature's head is out of view. Given this interpretation of its orientation and assuming the feature is intended to portray a face, one naturally would look for the most prominent features of any face, namely the eyes.

Eyes

At about the center of the image (just to the east of center, top being north) is a feature that appears to be a very detailed eye (Figure 3) including a) an appropriately tapered oval slit within a circular-like socket, b) an upper and lower eyelid, c) an eyeball displaying a portion of a circular iris and/or a full circular pupil within the iris, and d) whites of the eye near the temporal corner. Note the bottom lid margin and how it widens toward the temporal corner (reader's left) of the lid aperture. Detail of this sort is unexpected and it is

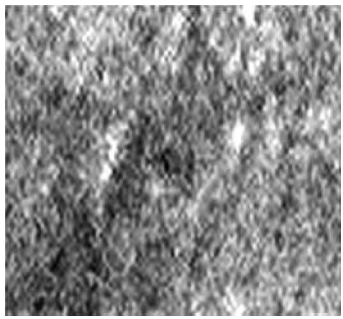

Fig. 3. The Skullface right eye.

therefore still more improbable that there should be two such formations, an accompanying left eye. But by careful examination of the head one will find a left eye located where the feature's right eye's mate should be if the object were an intentionally sculpted face. It is located on the head to the viewer's right and slightly higher than the feature's right eye, an asymmetry due to camera perspective. The second eye has almost exactly the same features as the first, although the upper and lower eyelids are not as visible, and the eye is slightly smaller. On the other hand, almost the entire circular iris and/or pupil is visible. Furthermore, this eye has the whites visible at both corners of the eye.

The feature's left eye socket is more circular than the right and the two eyes are not exactly the same. However, we do not believe this is a significant problem because not only do our eyes deform with facial expressions, but more importantly, such differences have been realistically portrayed in sculptures (for example in the Mt. Rushmore carving of George Washington below).

Mouth

There is a small mouth with closed lips. Its corners are raised slightly. The mouth is not a gaping mouth. There is a faint broken line marking the boundary between the closed lips. At the center, the top lip has a slight inverted curvature typical of a human lip.

Chin

The chin protrudes and curves, as would be expected, under the mouth.

Neck

The neck connects the head to the shoulders.

Nose

An upturned nose with bridge and two wide nostrils is located between the mouth and the eyes. It tapers back to a spot beneath and between the eyes. Shading suggests it protrudes outward from the rest of the face just as a nose should.

Scale and Resolution

MSSS lists the AB108403 image as having a scaled width of 4.67 kilometers. This means the skull is just over one kilometer wide. Scaled pixel width is 4.56 meters.

We believe the two eyes are the most compelling features of the Skullface image. Recognizing that neither of the authors are experts on eyes, we decided to call upon the opinion of two eye specialists, Dr. James Savage and Dr. Craig Small, independent optometrists from Caribou, Maine. The full reports from the two specialists are given in the Appendix. Here we outline the conclusions based on their interviews and measurements.

2. Comparison of the Two Doctors' Analyses

Two optometrists with no prior awareness of any theories of artificial objects on Mars independently validated the authors' impressions of eye-like features on the head-like formation in the 8403 image. Surprisingly, the doctors required very little prompting, both immediately and independently reaching for their rulers to measure the dimensions of the features. Both also independently noted numerous external parts of the eyes.

The doctors were allowed to use whichever media they preferred. Although Dr. Savage's computer displayed a better image, he was content with more approximate measurements. The printed image Dr. Small used was bigger and so may have prompted more meticulous measurements. Dr. Small made more of an effort to measure the eyes individually. Dr. Small made a measurement that Dr. Savage did not do, horizontal lid aperture.

The doctors had slightly different numbers representing known dimensions of average human eyes but they still were compatible. Both doctors found the Skullface eyes proportional to human eyes. In summary (see Appendix):

1. Both doctors saw two Skullface eyes.
2. Both doctors independently identified the main external parts of each of the Skullface eyes.
3. Both doctors noted that the eyes are slightly different but yet both saw them as a matched pair.
4. Both doctors stated (although in different ways) that the two eyes seem to work together in tandem, fixing on a target, or staring off. One doctor used the term ‘‘binocularity''.

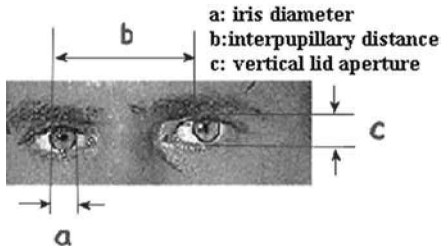

Fig. 4. Description of the eye measurements made by optometrists.

5. Both doctors showed that the Skullface eyes and their spacing are numerically proportional to those of human eyes by making basic measurements of the external parts.
6. Both doctors expressed the opinion that the Skullface eyes are a very good graphical representation of real human eyes.

Dr. Small also pointed out what he interpreted as the upper tarsal section of the right eyelid, the crease of the upper eyelid where the skin of the lid folds as it elevates. He also said that each of the eyes has two eyelids, a crease of skin under the lower one. He noted how the upper lids are bigger than the bottom ones and how at the nasal corner there is what could be interpreted as a two-part fleshy muscle called the plica/semilunaris. Both doctors noted the white part of the eyes, the sclera.

Although neither doctor is prepared to say for sure that these features are artificial, they both concede the eye-like features have the proper proportions and specific detail of real human eyes. As a result, both doctors independently validated our above impressions, immediately identifying the external parts one would expect in a pair of human eyes. Their detailed measurements add significant credibility to our claim that these are realistic eye-like features. Figure 4 shows a human figure depicting some of the measurements the doctors made.

3. The Eye of the Skeptic

In our opinion all these facial features taken together point toward an artificial origin. In fact this ''Skullface'' image, unlike the Cydonia Face, is more human-like than just humanoid. That of course makes the claim of artificiality all the more controversial (this is briefly discussed in the conclusion). Of course the skeptic can argue that humans from the time they are children are self-taught to see faces in the clouds. How can we be sure that something like this is not happening with this image? We would argue that although this could be a legitimate criticism for a facial feature in isolation, or maybe an overall grotesque face-like image, the features we see here in Skullface, espe-

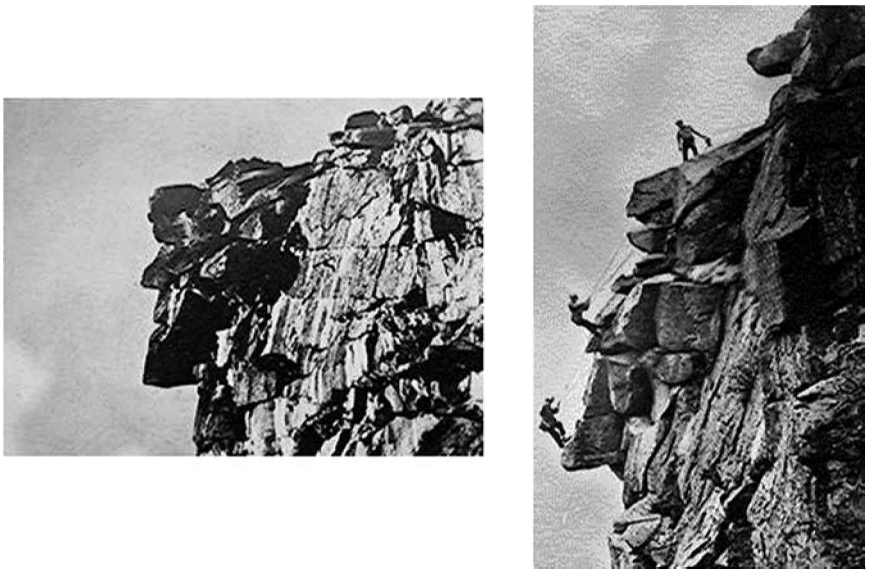

Fig. 5. Old Man in the Mountain in New Hampshire.

cially in the eyes, simply have too much detail and proportion to be dismissed this way. Rather than clouds, let us examine a more relevant criticism.

This criticism would be that in a typical irregularly shaped cliff scene, one could see a head and face with convincing facial features. Consider the images of the Old Man in the Mountain in Figure 5 and the head at the bottom right of Figure 6, a feature found in an aerial photograph of the Grand Canyon. The Old Man image does have a chin, mouth, nose, eye, forehead, and cheek, but unlike the Skullface, most of these features are grotesque. Furthermore, the eye shows no detail. Then there is the most obvious defect: there is no complete face in the image. Unlike the Skullface image, the Old Man is a profile of a three-dimensional feature and the impression of a face differs

Fig. 6. Head-like feature in the Grand Canyon.

drastically depending on viewing angle. By contrast, the Skullface feature is unlikely to appear differently from different angles because it is more two-dimensional and has a complete face, not a profile in space. The Grand Canyon head has a full face but it is quite grotesque. The eye sockets have no detail and the left and right sides are drastically different.

4. A Priori Probability Arguments and the Null Hypothesis

Dr. Thomas Van Flandern has used probability arguments based on *a priori* expectations to infer that the facial features of the Cydonia Face are not due to random effects (Van Flandern, 2002). Can similar arguments be employed here with the Skullface? The most obvious feature in this image is the skull/head-like aspect. However, we cannot legitimately use probability arguments based on its appearance, however unlikely, to argue against a natural explanation because its appearance is *a posteriori*. That is, we cannot attach any special significance to the appearance of this skull/head-shaped feature when there are many equally improbable shapes that could have drawn one's attention to a particular image. However, due to its oddly humanoid head-like shape we can consider further evidence, the prediction of additional and specific facial detail, for two competing hypotheses: (1) the object is an intentionally constructed artistic rendition of a humanoid skull or (2) just a chance shape formed by natural geological and erosive forces.

If this face were constructed to portray a human or humanoid face, then facial characteristics not seen at first viewing of the image would be expected during a more careful inspection of the image. It has been the experience of the authors, and of about all those to whom they have shown this image, that the skull-like feature jumps out[1] first (including the cheek and the chin/neck area). Then, normally with some hints given, the right eye of the feature is seen. Then the details are noticed. Some then see the second eye while others need more specific directions. But most everyone agrees that these are both eye-like features and the testimony from the two optometrists attests to the fact that the features are not just impressionistic but consistent with a detailed depiction of human eyes. Then one naturally looks for other facial evidence. The chin/cheek/neck area we assume to be part of the initial skull/head impression so we do not include it in our probability estimates. The lips, mouth, and nose would be expected next. So, the appearance of the eyes, their details, the lips, and the nose are *a priori* expectations based on the first hypothesis.[2] Thus it is legitimate to construct a statistical test for the second, or null, hypothesis; a determination of the chance of these features appearing conjointly by chance within the area of the head. The probability of the observed facial features coming together to form a complete, proportional face can be calculated by determining the frequency at which similar features appear on the planet's surface.

We begin with a consideration of possible natural causes of the primary features, the eyes. We claim that an impact crater is unlikely to produce such features. The reason is that the two eye-like features, each 200 to 350 meters across, not only have a tapered oval shape but also a partial (left eye) or complete (right eye) circular inner area. It is unlikely that an impact would form both types of symmetry (circular and oval). A vertical impact is normally circular. If it strikes at a grazing angle (more likely here because the feature is on a slope) then it would have perhaps an oval shape but more likely not symmetrical and certainly would not leave a circular center. It is the combination of these two incompatible symmetries (together with the other parts of the eyes pointed out by the optometrists) that makes impacts an unlikely origin. Most importantly, note for comparison the small impact crater slightly north of directly east of the feature's left eye. It is not circular like the iris on the left eye, but more oval by comparison. Furthermore, the oval is not double-pointed and it is of a lighter shade of gray.

This brings to mind another interesting aspect of the eye-like features: the iris/pupil portion is of a distinctly darker shade than the other parts of the eye-like feature. This could be caused by a difference in ground texture and color, possibly erosive forces that could have neutralized any natural colorings of the ground material. But it is more likely this dark coloring is due to a special form of shading that gives the impression of a dark circle. Also, there is visual evidence that the feature's left eyeball displays a ‘‘glint'' near the center of the iris/pupil area. What could cause two such simultaneous shadings?

An explanation for the impression of a glint may arise from an examination of sculptures with detailed eye features. There are some sculptures where a hole is cut into the ‘‘sclera'' for the ‘‘iris''. The hole is deep and angled enough to make a dark shadow, creating the impression of a darkened iris/pupil. Often, a small raised area is left in the middle. The small tip of this raised area reflects light like a real eye would, a glint. Figure 7 shows an example of this. Thus if the eye features are to have a natural origin then they must correspond to steep circular depressions and for the left eye a raised area in the center. Maybe an impact or small eruption that collapsed in the center could produce this. But the eruption would leave a low-lying cone-like feature not seen in either eye area. So if natural, is an impact the cause? Some impact craters do have a raised central area; however, as has already been mentioned, in this case an impact is unlikely to produce a circular depression encompassed by a pointed oval boundary. Yet two side-by-side, matching, mirror-imaged left/right eye-like features show this.

Just how unlikely is it for an impact, or any other geological mechanism, to produce an eye-like feature, one with a dark circle surrounded by a pointed elliptical boundary? Are there eye-like features found in isolation (or otherwise) elsewhere on the Martian surface? If so, how common, or rare, are they? Although our searches uncovered numerous features of similar shape and size, none of them (including several on the head) display anywhere near

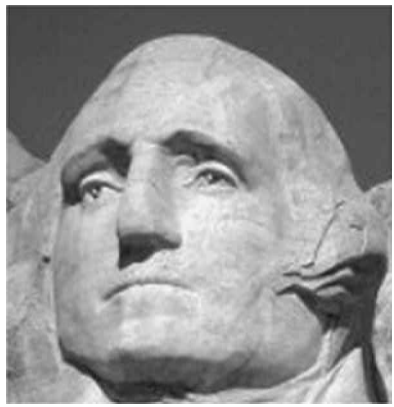

Fig. 7. Mount Rushmore sculpture of George Washington shows how a dark iris and glint can be obtained using sculpting techniques.

the kind of detail shown in the two eye-like features of the Skullface image. Nevertheless, some surprising results turned up.

5. The Search for Eye-Like Features

We decided to survey other MGS images in other areas of Mars in an attempt to determine the frequency of facial features similar to those found in Skullface. Eyes, considered the most detailed of the facial features on the Skullface, were deemed the most important.

The two Skullface eyes have the following eight characteristics (although only the right eye exhibits a pupil). If these are used to establish criteria by which one would consider an eye to be a ‘‘good'' eye, then an eye-like feature can be scored with respect to the Skullface eyes, eight-of-eight being a perfect score.

1. Pupil
2. Iris
3. Sclera
4. Pointed oval lid aperture, one point required for a profile eye
5. Upper and lower eyelids
6. Tarsal section
7. Eyebrow, cheekbone, or eye socket
8. Eye works in conjunction with other facial features to form a face-like image

Over 1460 MGS images were inspected for facial features, particularly for eyes. The total surface area inspected was about 184,000 square kilometers. The inspected image numbers, their locations, and comments were recorded

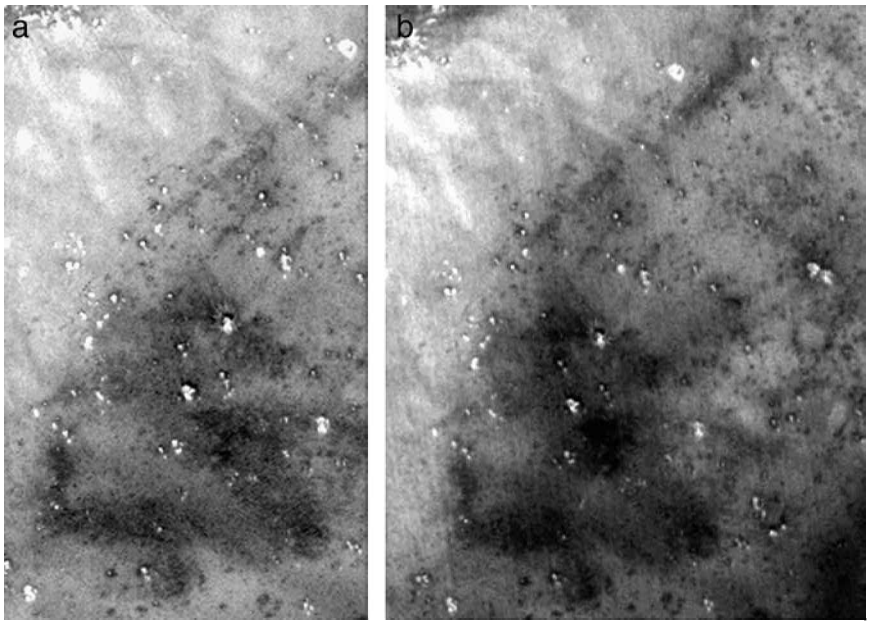

Fig. 8. (a) Recently released by MSSS, MGS #E0501429, a second corroborating image of left-facing profile of Figure 8b. (b) MGS #M0305549, a left-facing profile with whole, detailed eye.

in a spreadsheet for reference and for calculating inspected areas. Although we looked hard for isolated eye-like features, most of the eye-like features were found in conjunction with other facial features. What constitutes ‘‘good'' eye-like features can be subjective. However, this will not affect the point of this exercise. We focused on just the quality of the eye features as compared to those of the Skullface image. The result of the survey was quite surprising in that several fascinating face-like features were discovered. Furthermore, as expected, most of the good eye-like features tended to be found as part of overall face-like features. But only eight satisfactory eyes were found. We show three of them here: MGS images M0305549, M1600184, and M0300582.

In our survey for eye-like features in the Phoenicis Lacus region, we found a feature with the shape of a profile of a face (MGS #M0305549). Shown in Figure 8, the eye has a pointed oval lid aperture, iris, pupil, sclera, and is part of what appears to be a very good face overall. This gives a score of 6 out of 8. In addition, there are what appear to be thick eyelashes. Although we use this image to show an example of the type of eye-like feature we used to build a rough statistical base, it is difficult to avoid discussing the importance of such a find, one again displaying very human facial features. Note that in

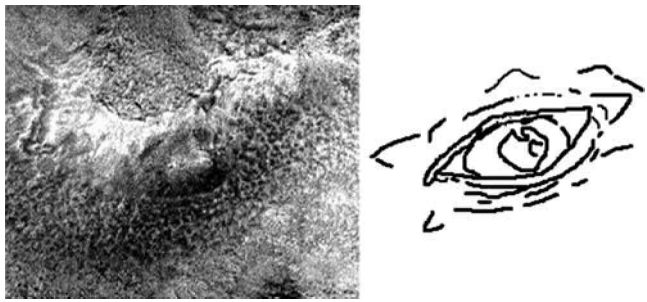

Fig. 9. Eye-like feature on the Cydonia face.

addition to the detailed eye there appears to be a forehead, nose with nostril, detailed lips, a chin, a neck, and a large hat. Shading gives the impression of a cheekbone and neck tendon. Furthermore, the contours, form, and proportion in the different shadings of grays are smooth and continuous, and do not possess the irregular angularity one would expect in a feature caused by random surface and albedo variation. This type of feature created by surface colorations on a relatively flat surface cannot be explained away with "tricks of light and shadow" because there are no shadows. "Differential erosion" is also an inadequate explanation because no erosion is evident. Although the cause of the dark areas is still unknown, possibly a seasonal effect, camera angle will not change the appearance of the feature in an unpredictable way. As a result, its flatness makes it all the more compelling and thus worth re-imaging. (*Note added in proof:* Very recently, in May 2002, NASA released image #E0501429 (taken June 2001), a second corroborating image of the left-facing profile in Figure 8b. This second image (Figure 8a) shows that the impression of a face is not an imaging artifact or fluke of light and shadow, but that the dark colorations, artificial or not, do indeed exist on the surface.).

Figure 9 is our second example of an eye-like feature located in a specific area on the Cydonia Face mesa. The eye in MGS image #M1600184 (and also visible in E0300824) has several distinct features including a pointed oval lid aperture, iris, pupil, sclera, and eye socket. This eye scores a 5 out of 8.

With eight satisfactory eyes discovered in a total area of 184,000 square kilometers, the rate of surveyed area (A_S) to satisfactory eye-like features (E_S) is

$$R_S = A_S/E_S = 184{,}000\ \text{km}^2/8 = 23{,}000\ \text{km}^2\ \text{per eye}$$

From the image width provided by MSSS, the width of the Skullface head can be computed to be approximately 1.2 kilometers. Approximating the Skullface head area as a square, the area containing the two eye-like features is 1.44 square kilometers or $A_{SF} = 1.44\ \text{km}^2$.

If eight eyes appear randomly over an area of 184,000 km^2, then a proportion can be used to determine how many eyes can be expected in a 1.44 km^2 area. The odds of one such eye-like feature appearing at random on the head-like area of the Skullface is then

$$A_{SF}/R_S = 1.44/23{,}000 \approx 1/16{,}000.$$

To be conservative, we discount the fact that none of the eight eyes found has as many details as the Skullface eyes, with the two Skullface eyes the highest scoring of all. The probability that two of these eyes would appear anywhere at random on the Skullface head area is then $1{:}16{,}000^2$ or one chance in about 2.6×10^8. In addition, the eyes are not located just anywhere on the head, but are positioned and oriented where two eyes should be if the object is indeed an intentional sculpture, so additional probability ratios can be factored in.

We now consider the angular orientation of the eye features. Relative to the head/skull, each eye has an orientation that is correct conservatively within about 30 degrees. In other words, since $360/30 = 12$, the probability is 12/1 against each eye having the correct angular orientation. (Like human eyes, the Skullface eyes have a top and bottom and so are not symmetrical under 180 degree rotations.)

In terms of their vertical placement on the head, let us say conservatively that the chances are 6 to 1 against having the correct vertical positioning because the head is about six times bigger vertically.

For two independent features, conservatively, the overall odds are therefore about $(12)^2(6)^2(16{,}000)^2$ to 1 against the two eyes appearing randomly in the observed head-like area and in their vertical and angular configuration. Although it is remarkable that the spacing and size ratios of the eye features match those of human proportions, we err on the conservative side and neglect introducing any further probability factors.

The next independent facial feature we consider is the nose. The nostrils, although circular and side-by-side, are unlike the eyes in that they do not have further distinguishing features, so we do not include any appearance rate statistics as we did with the eyes. We do, however, include a probability calculation for proper location on the head. That would be just the ratio of the nose area to the Skullface head area. The width of the feature is approximately 0.20 kilometers so the area of the nose is approximately 0.040 square kilometers. The odds of the nose being located correctly on the head is then

$$A_{nose}/ASF = 0.040/1.44 = 1/36$$

The nose has two side-by-side nostrils. The bridge of the nose passes between the nostrils from between the eyes. So the nose is positioned correctly

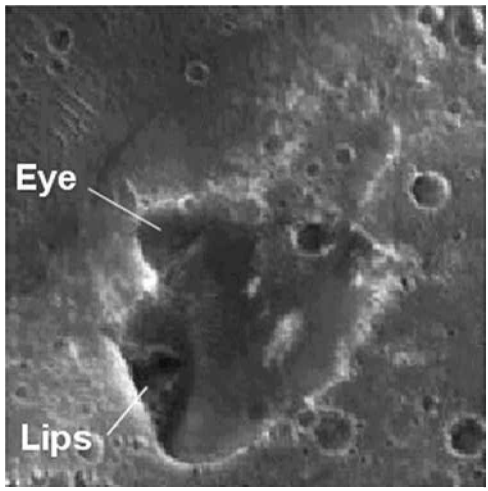

Fig. 10. Face-like feature with realistic looking lips. MGS M0300582.

in its rotational orientation, much like the eyes. Using the same probability estimates as used with the eyes, the chance of this is 1/12.

The lips/mouth are another matter. Unlike the nostrils, they are distinct and not at all an ordinary or common surface feature. The image search produced only one good candidate for lip-like features (MGS #M0300582) of the same or better quality as those on the Skullface feature (see Figure 10). Again, not surprisingly, these were recognized in the context of a face-like profile. This face-like object was discovered in the Oxia Palus region, a profile that has what appear to be full lips, a chin, cheek, ear hole, and a single eye.

It is difficult to estimate the bias of only noting lip-like features that are in the context of a face-like feature. On the one hand it is safe to say that such features would be more likely to be spotted if there was a face or head-like area that drew one's attention to it. (Note that this face-like feature also has a low scoring eye-like feature as well. It is one of the eight mentioned above.) With just one other candidate for lips found other than the Skullface image (as opposed to eight candidates for eyes), we can only crudely estimate the odds against such a feature appearing randomly. Conservatively, we use the same ratio as for the eyes, that the odds are 16,000 to 1 against such a feature appearing randomly.

We limit ourselves to these three primary facial features (eyes, nose, mouth) of the Skullface image. Using these factors the overall probability is then $(E_R\, E_V\, E_A)^2\, M_R\, M_V\, M_A\, M_H\, N_R\, N_A$, where

E_R = the rotational orientation of one eye = 12/1,
E_V = the vertical positioning of one eye = 6/1,

E_A = the eye area to survey area ratio = 16,000/1,
M_R = the rotational orientation of the mouth = 12/1,
M_V = the vertical positioning of the mouth = 6/1,
M_H = the horizontal positioning of the mouth = 6/1,
M_A = the mouth area to survey area ratio = 16,000/1,
N_R = the rotational orientation of the nose = 12/1, and
N_A = the nose area to head area = 36/1.

These independent features work together to form the Skullface face. When independent phenomena occur conjointly or consecutively, their probability ratios are multiplied. Consequently, the probability of the observed independent facial features coming together to form a complete face is

$$[(12)(6)(16{,}000)]^2(12)(6)(16{,}000)(6)(12)(36) \approx 4 \times 10^{21}$$

to 1 or 4 sextillion to 1 against these three independent facial features appearing in the correct location and orientation within an area the size of the Skullface head. To be conservative, many factors such as the individual eye features have not been included. The above probability is clearly small enough to call the null hypothesis into question; that such a juxtaposition of face-like features located on a head-like feature of a rounded skull with cheeks and chin could occur reasonably by chance[3].

Normally statistical analysis is used to test whether a phenomena's likelihood is within the purview of chance and is not used when a phenomena is blatantly apparent. It could be argued that even the strongest statistical arguments supporting artificiality are not going to convince anyone who does not at least suspect artificiality upon viewing the images themselves. However, if one accepts that the individual eye, nose and lip features exist and have the proper geometrical characteristics, but yet collectively these features still do not register much of an impact with the viewer, then at some level the viewer must have concluded that such a set of events are not that unusual. One purpose for presenting this statistical analysis is to show numerically just how unusual these features, taken together, indeed are.

6. Conclusion

The Skullface image displays a recognizable skull shape together with cheek, chin, neck, two matching detailed eyes, nose with nostrils, and mouth. The probability of these independent features appearing conjointly by chance is miniscule. Most importantly, the eye features are detailed and proportional to those of a human, as confirmed independently by two eye specialists. The nostrils, although faint, have the correct placement on the head. The lips have the correct size, shape, and relative placement. Is this feature an intentionally

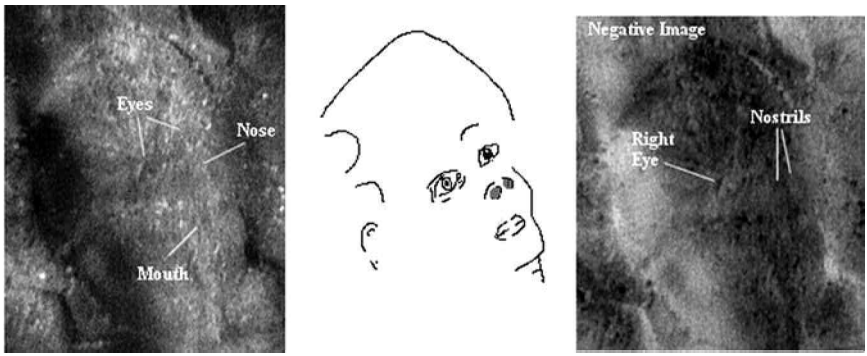

Fig. 11. Tracing of the main facial features of Skullface.

created surface sculpture on the planet Mars, one reminiscent of many analogous terrestrial works of art such as the Blythe Antaglios, the Crazy Horse Memorial, the Great Sphinx, or the Nazca Lines? In our opinion there is too much detail and proper proportion to ascribe the impression of a sculpted face to extrapolations carried on by the mind. We therefore feel new images of the Skullface area should be taken whenever opportunities arise and that because of the profound importance of such potential archeology, this object is deserving of a certain level of mission priority.

It has been the experience of the authors that discussions as to the possible artificiality of these Martian features leads inexorably to questions regarding their origins. We do not intend to discuss these questions in any detail here. At this point in the analysis of the Skullface and other images (annotated images given in Figures 11, 12 and 13), no causal mechanism for artificial origins can be made with any certainty. However, these are indeed the ultimate and important questions, questions with profound implications: Who made them? Why? When? How? And why so *humanlike*? This last intriguing ques-

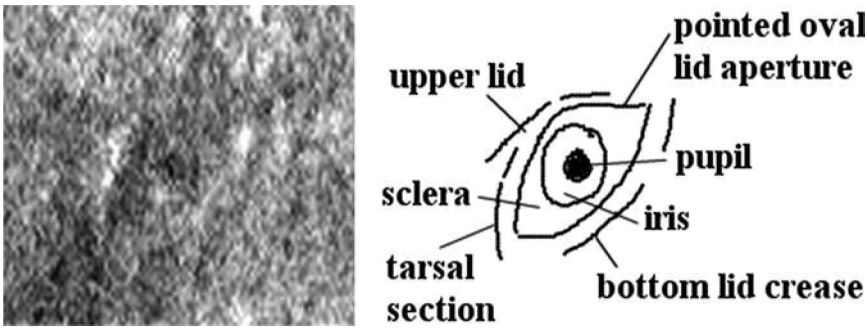

Fig. 12. Parts of the right eye identified in Skullface.

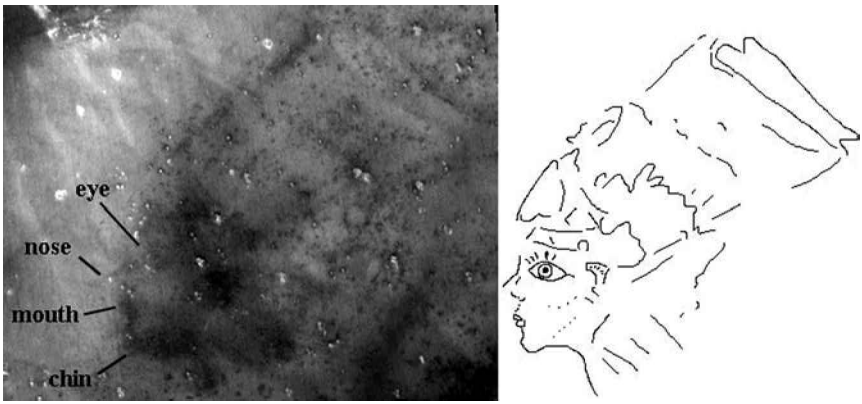

Fig. 13. Profile Image M0305549 with facial features depicted.

tion, stemming from the evidence presented here, makes the whole artificial origins hypothesis all the more controversial—the *human-ness.* The reason for this is that the existence of the human-like faces seems to require that either there was a past space-faring civilization from Earth, now long forgotten, that traveled to Mars and made the objects, or that indigenous human-like beings evolved independently on Mars and made the anomalous features, or that a human-like extraterrestrial species from outside our solar system, possibly involved in the very origins of humans on Earth, was responsible. The controversy engendered by the question of ''why so humanlike'' would then become focused on speculative origins scenarios that conventional evolutionary biology would deem unacceptable. This would tend to overshadow the more important discussion of the *evidence itself,* with detractors questioning the evidence not on its own merit but rather because there is no acceptable theory as to the artificial origins of these features. Unpalatable origins scenarios do not, however, negate the evidence.

We might suggest a less controversial artificial origins theory, one involving one or more nondescript extraterrestrial species traveling through our solar system and creating structural features or artwork on Mars reflecting what was seen by them on Earth at the time. This type of theory diffuses the criticism the above theories tend to invite, since it would require no radical changes in our ideas of human evolution and development, no alterations in conventional notions as to the conditions and time frames needed for life to develop independently on Mars, and, more importantly, the *human-ness* of the faces does not require that the artists and builders be even remotely related to humans. What is required, though, is the acceptance of an extraterrestrial visitation to Earth and Mars sometime in the not too distant past. In this case these anomalous Martian features, if indeed artificial and the result of extraterrestrial interventions, would not be about Mars, but about Earth, meant, by

virtue of their subject, for us alone as a clear and unambiguous message that intelligent life does exist outside our solar system.

Notes

[1] It has been suggested that tests could be performed in which observers' reactions could be recorded. A simple experiment would be to erase certain facial details to see if the impression of a skull is retained. This would more rigorously determine if indeed the humanoid head can be given *a priori* significance. (We acknowledge Cesar Sirvent for this suggestion.)

[2] The mind tends to fill in detail where it is missing, such as when an object is recognized when viewed from behind a picket fence. It is possible that the mind can be fooled in this manner. On the other hand, real features can also be recognized.

[3] Typically odds of 1/100 or larger are taken to be within the purview of chance. However, recently Matthews (1999) has suggested that such measures of 1/100 have been shown to be unreliable indicators of the existence of genuine anomalous effects. According to his table of adjusted p values, the maximum value for significance with a high level of skepticism is on the order of 10^{-6}, fifteen orders of magnitude larger than our ''p'' value. Our ''p'' value would be slightly increased if we had included probabilities of important facial features that did not appear. However, these small probabilities would not change the failure of the null hypothesis in any significant way.

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Appendix: Examination of the Skullface Eyes by Two Optometrists

A. Interview with Dr. James Savage, O.D., Re: Skull Face Eyes, August 19 & 26, 2000

Measurements of the eyes of the Skullface were made by displaying AB108403 on a computer screen, increasing contrast and brightness, zooming in, and measuring the eye-like features with a millimeter rule. Dr. Savage downloaded the image directly from msss.com himself. The measurements were done within a certain amount of error due to resolution and the fact that the face is turned approximately thirty degrees. Measurements were made to the nearest millimeter.

Since the doctor is familiar with the proportions of normal human eyes, a comparison was made with those measured on Skullface. The doctor noted that because of shadow and perspective the two eyes appear to be slightly different but he decided that the eyes are alike enough to treat them as approximately the same. He also noted that these measurements are to be compared with approximate known human measurements which vary between individuals. He measured for overall proportion, compared to human eyes.

(A.1) The Computer

The image was displayed on the doctor's own Inteba computer with a 17-inch Spectrum monitor. The image was saved in and contrast/brightness enhanced using Photo Shop 4.0.

(A.2) The Three Eye Measurements

Iris diameter. The iris is the colored part of the eye surrounding the pupil.

Inter-pupillary distance. Horizontal distance between the pupils, measured from the outer edge of one iris to the nasal edge of the other.

Vertical lid aperture. The opening the lids make.

Normal human parameters are typically as follows:

Iris diameter. Average of 12 mm, or between 11–13 mm (little variation due to age).

Inter-pupillary distance. Average of 60 mm, 50 mm in young children and up to as much as 73 mm in large adults (varies greatly depending on age and overall size of the individual).

Vertical lid aperture. 9 mm (Small variation in individuals).

The Skullface measurements, given the scale of the zoomed-in graphic, are as follows:

Iris diameter. 4 mm.

Inter-pupillary distance. 20 mm.

Vertical lid aperture. 3 mm.

(A.3) A Pair of Eyes

The Skullface iris diameter and lid aperture measurements are approximately the same in both eyes. As far as these particular measurements are concerned, the two eyes are a matching pair.

(A.4) Conclusion Regarding Proportion

When the Skullface measurements are compared to the normal dimensions of real eyes, a factor of about three applies to all three measurements. These correspond closely to the dimensions of human eyes. The dimensions of the Skullface eyes are proportional to human eyes.

(A.5) Binocularity

The eye-like features give the impression of being fixated on a target at a particular distance and working in tandem. The eye-like features thus exhibit binocularity.

(A.6) Shape of Lid Aperture

The lids form a pointed oval or almond shape, as is expected in real human eyes.

(A.7) Shape of Iris

The two irises are round.

(A.8) Conclusion

Although Dr. Savage is not prepared to say for sure that these features in Candor Chasma are artificial in origin, he concedes the eye-like features have the proper proportions and specific detail of real human eyes.

B. Interview with Dr. Craig Small, O.D., Re: Skullface Eyes, August 24, 2000

(B.1) Variation in Pupillary Distance

Measurement of pupillary distance will vary as much as three millimeters depending on gaze because the eyes will move together or apart depending on the distance of the target. It's difficult to tell if the eyes are fixed on a target or simply gazing off into space.

(B.2) Printed Image

Dr. Small selected an HP 1120c print of Skullface. The paper was matte photo quality. A tight cropping measured 148 mm wide by 260 mm high. Features were measured to the nearest millimeter.

(B.3) Pupils and Pupil Dilation

The doctor did not see pupils in the printed image. He said if he could see pupils, he might have been able to speculate on the state of the individual by noting any pupil dilation.

(B.4) Pair of Eyes, Slightly Different

The doctor's general observation is that the two eyes are very similar in size and shape. Yet through careful measurement, it appears the right eye is smaller. However, this difference may be due to an obstruction the doctor saw in the nasal area of the right eye, a shadow he observed, or the camera angle.

(B.5) Parts of the Eyes

The doctor identified the external parts of the eyes on the printed graphic, labeling them in pen: the upper tarsal section of the lid (right eye only), iris/cornea, medial canthus, lateral canthus, and sclera.

(B.6) Shadow on Right Eye

The doctor saw a feature between and just above the eyes that might be pushing down on the right eyebrow (if indeed a sculpture), causing the palpebral fissure to be smaller. This feature also seems to be casting a shadow across the right eye (from nasal to temporal), darkening the nasal corner of the right eye such that the sclera is obscured. He noticed that different prints of the image provided better views of different areas, the left eye being brighter. A bit of the same shadowed area of the sclera is visible in a different print.

(B.7) Measurements from the Skullface Print

1. Pupillary distance = 33 mm.
2. Cornea (or iris) diameter, right eye = 4 mm; left eye = 6 mm.
   It is difficult to measure iris diameter and lid opening on the right eye because
   a. the nasal limbal junction (where cornea meets sclera) is not well defined due to an obstruction (straight dark band obscuring sclera),
   b. the camera angle or perspective,
   c. of a shadow cast by a feature above and between the eyes over this area.
3. Palpebral fissure (lid opening), right eye = 6 mm (vertical); left eye = 8 mm (vertical); right eye = 9 mm (horizontal); left eye = 11 mm (horizontal).

(B.8) Known Human Dimensions

a. Approximate pupillary distance = 63 mm,
b. approximate iris diameter = 12 mm,
c. approximate vertical palpebral fissure = 12–14 mm (in normal state, not surprised or sleepy, about the same as iris diameter, varies greatly in individuals),
d. approximate horizontal palpebral fissure = 20 mm.

(B.9) Ratios of Human to Skullface Dimensions

Inter Pupillary Distance	=	63/33=1.9	
		Right Eye	*Left Eye*
Iris Diameter	=	12/4 = 3	12/6 = 2
Vertical Palpebral Fissure	=	13/6 = 2.2	13/8 = 1.6
Horizontal Palpebral Fissure	=	20/9 = 2.2	20/11=1.8

(B.10) Proportion

When the measurements of the Skullface print are compared to known human eye measurements, an approximate factor of two applies to all four measurements. The doctors ended up with slightly different factors because the media they used were at different scales.

Editorial Comment

Several referees expressed disagreement with the interpretation and the statistical analysis invoked to support it. But these are not hard-and-fast issues. Anomalists, perhaps even more than mainstream scientists, have been forced to recognize that statistical analysis has an inevitable subjective aspect, so that any conclusion of 'statistical significance' is actually the expression of an opinion as to what the odds are.

In this case, statistics is being used 'ex-post-facto', that is to say the feature was first identified as resembling a face and then the probabilities calculated that it should look like one. But it should be evident that once something has been seen to resemble a face, the probability must be high that its features will be face-like. The real question is, among how many photos of Martian landscapes is one likely, by chance, to find a feature that resembles a human face?