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Does Insect/Arthropod Biodiversity Extend Beyond Earth?

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ABSTRACT

There is ample evidence to answer the question posed by the title in the affirmative. For several years, I have been engaged in study of the NASA-JPL photographs transmitted to Earth from the surface vehicles sent to explore Mars, Curiosity Rover in particular. These photos are available to the public via the internet.

In this poster, I present and discuss numerous examples of insect/arthropod-like forms (fossil & living) found in Mars rover photos. Examples include insect-like forms displaying apparent diversity, clearly recognizable insect/arthropod anatomical features, and flight. Evidence of a fossil reptile-like (serpentine) form as well as apparent living reptile-like forms preying on insect-like forms is also presented. Each example is documented. These findings provide a compelling basis for further study and raise many important questions. (DOI: 10.13140/RG.2.2.11836.39041)

INTRODUCTION

Interest in the possibility of life on Mars (Dass, 2017), a desire to find useful resoures for technology, possible colonization (Levine & Schild, 2010), and a great sense of adventure has stimulated research and development in regard to reaching Mars. Accordingly, earlier projects involved placing spacecraft in orbit around Mars to send back photos of the Martian surface. More recently, unmanned vehicles have been sent to land on the Martian surface to relay images of the surroundings back to Earth and to collect information about the surface and from shallow drill holes. Onboard instrumentation has tested for evidence of past and present life via indicators of organic activity, namely “biosignatures” (Cady et al., 2004; Levin, 2019).

Another approach has been to seek out and analyze the structural, physiological, and biochemical adaptations of Terran organisms that are able to live under extreme environmental conditions, that is “extremophiles” (Merino et al. 2019,). This approach has been almost entirely focused on microbes, though metazoans, e.g. tardigrades, and some insects and reptiles have been found in extreme habitats on Earth.

My intent in this poster is to present evidence of fossil and living insect- and reptile-like forms on Mars. A few of many findings are included and additional results will be published soon. Repeatability and corroboration are among the hallmarks of the scientific method and as it is likely that at least some NASA/JPL personnel are acquainted with Martian insect- and reptile-like creatures, the research reported here can reasonably be viewed as replicative and corroborative.

The arthropod body plan with repeating body segments, a typically tough, resilient exoskeleton, along with a high degree of physiological and biochemical adaptability are among the characteristics that make members of this group prime candidates for thriving under harsh environmental conditions. Likewise Terran reptiles are commonly found in extreme environments.

Based on preliminary examination of Mars rover photographs, I formulated the following broad, hypothesis as the basis for the research reported here: There are fossilized and living forms on Mars, including insect/arthropod- and reptile-like forms.

MATERIALS & METHODS

The NASA-JPL images relayed to Earth by land-based vehicles (“rovers”), sent to Mars via spacecraft are available to the public on the internet. This database of photos, both raw images and compiled panoramic mosaics, that has been collected over many years by several different missions has been used in this study, mostly from Curiosity rover (NASA/JPL). Individual images were carefully studied while varying photographic parameters such as brightness, contrast, saturation, inversion, and so on. No content was added, or removed.

The following criteria were useful in identifying life forms: dramatic departure from the surroundings, clarity of form, body symmetry, segmentation of body parts, repeating form, skeletal remains, and observation of forms in close proximity to one another. Particular postures, evidence of motion, flight, apparent interaction as suggested by relative positions, and shiny eyes were taken to be consistent with the presence of living forms. Once a clear image of a given form was identified and described, it was useful in facilitating recognition of other less clear, but none-the-less valid, images of the same basic form.

The descriptions and interpretations of images are somewhat tentative, and may well change with more study and as knowledge of Martian fauna increases. I encourage you to check my findings for yourself. The URLs of the photos used will be listed on my website, scienceofentomology.com and in formal publication of this material in the future.

RESULTS

It appears that the “Red Planet” enjoys a surprising abundance of higher life forms.

An exoskeleton and jointed appendages are sufficient to establish identification as an arthropod (Romoser & Stoffolano, 1995). Three body regions, a single pair of antennae, and six legs are traditionally sufficient to establish identification as “insect” on Earth. These characteristics should likewise be valid to identify an organism on Mars as insect-like. On these bases arthropodan insect-like, forms can be seen in the Mars rover photos.

Many insect-like creatures and putative diversity were observed (Plate 1). The most common insect-like forms are robust and loosely resemble bumble bees or carpenter bees on Earth. For convenience, with no taxon necessarily implied, I’ll refer to these creatures as “bees” from this point on. The “bees” appear to vary in size and type.

Several characteristic insect/arthropod anatomical features were identifiable (Plate 2), not all on the same individual, but as a mosaic among individuals.

Distinct flight behavior was evident in many images, e.g. Plates 3 & 4. In one case observed, the flight manuever was impressive with the individual “bee” plunging straight down the side of a cliff and leveling off just before hitting the ground (Plate 4).

The insect-like fauna observed appeared to be sheltering/nesting in caves (Plate 3E), in burrows beneath the surface, and in specialized structures.

Possible predation of the insect-like types by reptile-like creatures (Plate 5) and putative insect-like (“bee”) and reptile-like fossils were seen (Plate 5).

The descriptions/interpretation of insect- and reptile-like creatures described here are tentative and may be changed in the future as knowledge of putative Martian Fauna increases with further study.

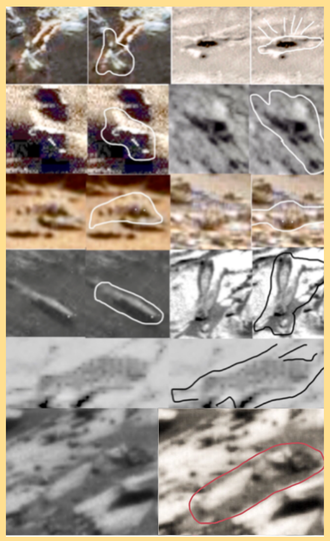

Plate 1. Insect-like forms, most of which display three body regions (head, thorax, & abdomen) and wings that articulate with the thorax. The fourth image from the top on the left side has only a head and trunk and could be an immature insect-like form or another kind of arthropod.

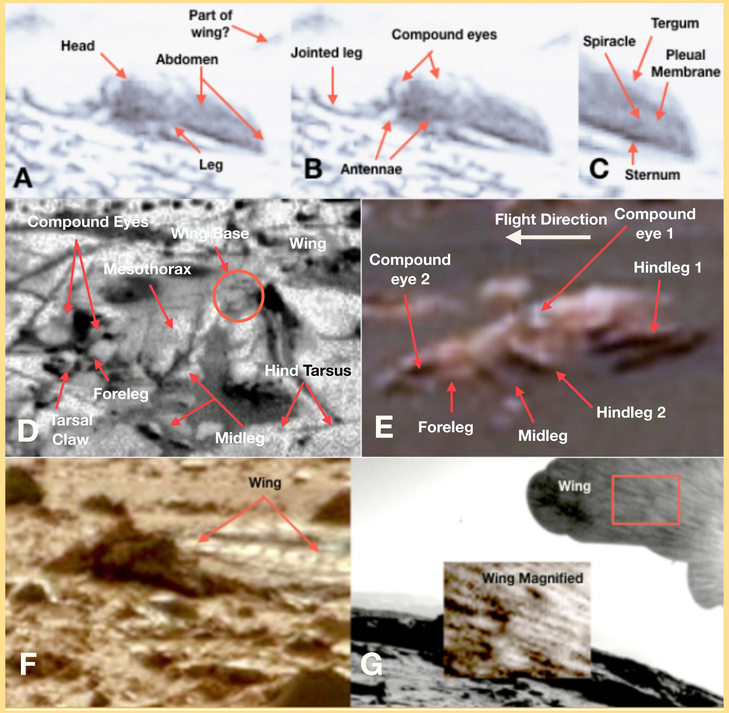

Plate 2. Various anatomical structures seen in different photos. A - E and probably F are “beelike”, but not necessarily the same type. (A & B) A specimen whose head appears to have turned in the direction of the camera (based on the scale provided in the photo from which this was extracted, this individual is estimated to be approximately 20 inches long). (C) Abdomen of specimen from “a.” (D) Individual on ground with head facing left with head & thorax visible. (E) Individual flying with legs evident and, though in flight, somewhat comparable to the specimen in D; Compound eyes and hindlegs labeled in two positions since in motion. Relative to D & E, the locations, shapes, sizes, and appearance of the legs suggest that the forelgs, with putative distal chelate structures, are grasping; the midlegs, digging; and the hindlegs, jumping & running. (F) Specimen on ground with wing(s) toward the right. Longitudinal veins, cross veins, and wing cells evident. (G) Part of wing of specimen apparently caught on the rover; inset: enlarged portion of wing. Longitudinal veins, cross veins, and cells are evident.

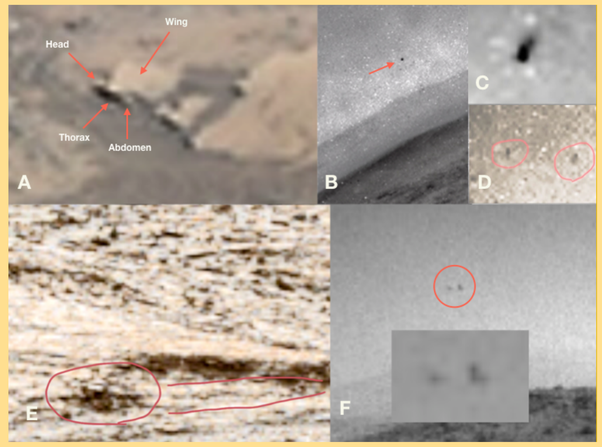

Plate 3. Insect-like forms in flight. (A) At least two apparent insect-like creatures flying close to one another. (B) Putative insect-like forms in a darkening sky. (C & D) Extracts from “b” with evidence of wings beating (light spots encircling the dark bodies). (E) An insect-like specimen (“bee”) that appears to have flown right to left from what could be a cave or an entrance to the underground. (F) Two putative insect-like specimens in flight contrasted with the darkening sky; Insert: enlarged view.

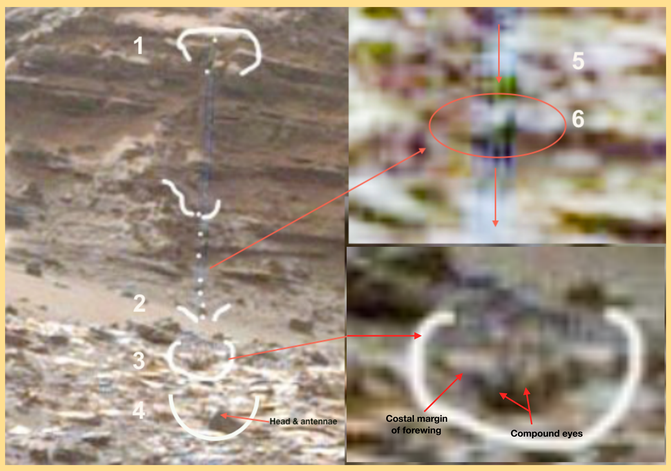

Plate 4. A dramatic acrobatic stunt with the individual gliding/flying from the top of the cliff (1) nearly to the ground (2) and then leveling out heading toward the camera (3 & 4). The multi-lined stripe is the blur associated with descent (5) with the blurred head of the individual periodically showing (6). A flurry of “bees” can also be seen gliding/flying away from the cliff face.

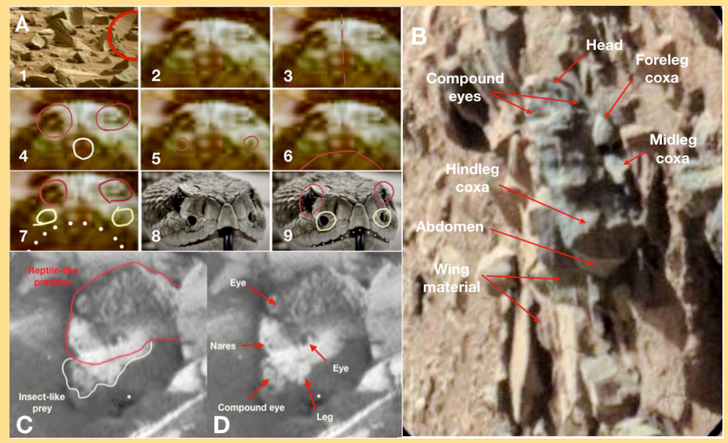

Plate 5. (A) Frontal view of a putative reptile-like fossil compared to a Terran snake. 1.Frontal view of putative fossil (circled) in a debris field. 2. Enlarged frontal view of fossil. 3. Midline symmetry indicated. 4. Eyes and small oral opening circled. 5. Bilateral punctate structures indicated. 6. large, full-gape, oral opening. 7. Eyes, lateral punctate structures, and large mouth capable of gaping are indicated. 8. Frontal view of Eastern King Snake head (Original photo). 9. King snake with eyes and bilateral punctate structures circled. (B) Putative fossil insect on its dorsum with head to the top, and with selected structures labelled. (C & D) Apparent predatory behavior showing reptile-like creature with insect-like creature in its mouth.

CONCLUSIONS

Evidence presented here supports the following:

There are fossilized insect- and reptile-like forms on Mars.

There are extant insect- and reptile-like forms on Mars.

There has been and still is life on Mars.

The presence of wing veins and spiracles are consistent with tracheal ventilation.

There is apparent diversity among the Martian insect-like fauna which display many features similar to Terran insects that are interpreted as advanced groups, for example the presence wings, wing flexion, agile gliding/flight, and variously structured leg elements.

Sheltering and nesting of the insect-like forms in caves and possibly burrows beneath the surface are consistent with life in a harsh and variable environment.

Insect-like Martian forms appear to be preyed upon by reptile-like forms.

DISCUSSION

To my knowledge, aside from circumstantial evidence presented in the literature (Levin, 2019), the meaning of which is debated among astrobiologists, this is the first professional report of direct evidence of identifiable life forms beyond the confines of Earth. While any given image does not in itself prove anything, I believe the mosaic of what I have described is compelling. And as stated above, I view the research reported here to be replicative and corroborative. It is very clear that much more study of the photos is needed. The information presented here barely scratches the surface.

Given our current understanding of the fundamental ways living organisms function, and the putative patterns of the evolution of life on Earth, I would guess that most biologists have expected to find life on other planets, and would not be particularly surprised to find carbon-based biological processes/mechanisms as well as similarities in patterns and interactions at the various levels of organization. This is not to say there couldn’t be other-than-carbon systems operating as well. I also think we can logically expect to find evidence of the operation of evolution and natural selection. Discussions pertinent to these ideas include the following: Sephton & Carter, 2015; Cabrol & Grin, 2018.

The presence of higher metazoan organisms on Mars implies the presence of nutrient/energy sources and processes, food chains and webs, and water as elements functioning in a viable, if extreme, ecological setting sufficient to sustain life. I have observed instances suggestive of standing water or small water courses with evident meander and with the expected blurring of small submerged rocks, larger emergent rocks at the atmosphere/water interface, a moist bank area, and a drier area beyond the moist area. Water on Mars has been reported a number of times (Rothschild and Mancinelli, 2001), including surface water detected by instrumentation on Viking, Pathfinder, Phoenix and Curiosity (Levin, 2019).

The question that looms especially large at this point is consideration of how life forms reach a given planet (or any cosmic body), that is the question of origin(s) of life. Stated in terms of this research, did life originate on Earth and Mars independently; or did it originate on either Mars or Earth and find its way to the other; or finally did life find its way to these planets from elsewhere in our solar system, galaxy, or beyond? Hopefully the findings reported here will enter into the exciting discussions of panspermia (Crick, 1981; Russell et al., 2011; Journal of Cosmology.com, 2010; Kaufman, 2017).

The evidence of life on Mars presented here provides a strong basis for many addtional important biological as well as social and political questions. It also represents a solid justification for further study. A recent book published by the National Academies of Sciences, Engineering, and Medicine (2019) looks to the future of astrobiology and recommends strategies for the further development of this field. Given evidence for the presence of insect/arthropod- and reptile-like organisms beyond the confines of Earth, perhaps “astroentomology” and “astroherpetology” will emerge as important topics within the field of astrobiology.

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Mars rover photos courtesy of NASA/JPL.

URLs for photos used in this study will be available upon publication.