A classification of silicon-utilizing organisms to assess the silicon ecosystem

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A new approach

Silicon utilizing organisms may be defined as organisms with high silicon content ($\geq$ 1% dry weight) and they can metabolize silicon with or without demonstrable silicon transporter genes (SIT) in them [1]. It is well known that organisms with high silicon content can survive in extremes of temperature, pressure, radiation, pH, salinity and nutrient conditions. Only few minerals are found more than 1% in plants- mainly N, K, Si, Ca and Na. While ecological aspects of N, K, Ca, Na are well known, the role of silica in terrestrial ecosystems is not sufficiently understood. Thus a classification of silicon utilizing organisms is important to assess the silicon ecosystem.

Discussion

Main groups of silicon utilizing organisms – algae, protozoa, sponges, monocotyledon plants, fungi, lichens, Gram positive bacteria are further classified up to genus levels according to their utilization of silicon. Among algae Phylum Bacillariophyta, Class Centrobacillariophyceae, Class Pennatibacillariophyceae, Order Pennales (Pennate diatoms), Phylum Chrysophyta Class Chrysophyceae are important. Among protozoa Phylum Heterokonta, Phylum Choanoflagellida, Phylum Actinopoda Class Polycystinea, Class Phaeodarea, Class Heliozoea are important. Among different sponges Class Hexactinellida (Hyalospongiae, glass sponges), *Euplectella* (Venus's flower basket), Class Demospongiae and Class Sclerospongiae are important. Among monocotyledon plants Division: Pteridophyta, Class: Equisetopsida, Order: Equisetales, Family: Equisetaceae, Division: Magnoliophyta Class: Liliopsida, Order: Poales, Family: Juncaceae, Family: Poaceae, Family: Bromeliaceae, Family: Cyperaceae, Family: Marantaceae, Family: Araceae, Family: Agavaceae, Family: Laxmanniaceae, Family: Ruscaceae, Family: Araliaceae, Family: Rutaceae, Family: Cucurbitaceae are important. Among fungi Phylum: Ascomycota, Family: Trichocomaceae, Family: Moniliaceae, Family: Dematiaceae are important. Almost all lichens and Gram positive bacteria belong to the group of silicon utilizing organisms.

[1] Das (2010) *Lunar Settlements* (ed. Benaroya) CRC Press, pp.679-92.

Isotopic anomalies in meteorites: A link between stars and planets

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Isotopic anomalies represent departures from the laws of mass-dependent fractionation that cannot be ascribed to any commonly encountered nuclear reaction such as radioactive decay. They affect materials of all sizes, from nanodiamonds to planets. Isotopic anomalies of nucleosynthetic origin provide important constraints on stellar nucleosynthesis, circumstellar dust condensation, protosolar nebula mixing, and planetary formation.

Recent studies have shown that for many elements, isotopic anomalies are present at the scale of bulk planetary materials [*e.g.* 1-5]. In those cases, isotopic anomalies can be used to identify genetic relationships between planetary objects. For instance, Mo and Ru show correlated variations of *s*-process isotopes in bulk chondrites [1-3]. Mo and Ru in the terrestrial mantle were delivered before and after the completion of core formation, respectively. Thus, the fact that the mantle composition plots on the correlation defined by chondrites suggests that the composition of the material accreted by the Earth did not change through time [2]. Isotopic anomalies can also be revealed by sequential acid leaching of meteorites [6]. Such anomalies have been found for Os isotopes [*e.g.* 7]. Improving on *s*-process predictions in the Os mass region is important to estimate the amount of cosmoradiogenic ^{187}Os in the solar system and hence the age of the Galaxy. Isotopic anomalies can reveal the presence of yet unidentified presolar phases in meteorites. The carrier of ^{54}Cr anomalies has eluded detection for almost 20 years [6] but two recent studies have identified ^{54}Cr-rich grains in residues of primitive meteorites [8, 9]. These grains were likely condensed in supernova ejecta.

[1] Dauphas *et al.* (2002) *Astrophys. J.* **565**, 640–644. [2] Dauphas *et al.* (2004) *Earth Planet. Sci. Lett.* **226**, 465–475. [3] Chen J.H. *et al.* (2003) *LPSC* **34**, #1789. [4] Trinquier *et al.* (2007) *Astrophys. J.* **655**, 1179–1185. [5] Simon *et al.* (2009) *Astrophys. J.* **702**, 707–715. [6] Rotaru *et al.* (1992) *Nature* **358**, 465–470. [7] Reisberg *et al.* (2009) *Earth Planet. Sci. Lett.* **277**, 334–344. [8] Dauphas *et al.* (2010) *LPSC* **41**, #1073. [9] Nittler *et al.* (2010) *LPSC* **41**, #2071.