Hyperarid extremophiles: A comparison of bacterial communities from distinct locations in the core of the Atacama Desert

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The driest sector of the Atacama Desert in Chile provides an excellent laboratory for investigation of the limits of microbial life in hyperarid microbial ecosystems [1]. This investigation examines the bacterial diversity comprising hyperarid, oligotrophic microbial communities and explores the basic parameters charcterizing such limited ecosystems. Recent analysis of noncultured microbial communities (DGGE profiles of 16S rRNA genes) along an east-west elevational transect (23.75 to 24.70°S) through the hyperarid core region of the Atacama Desert revealed that bacterial communities clustered into two separate groups [2]. The first group included samples taken from 700 – 1931 m in the core region of the desert, while the second cluster included samples from the western slopes of the Domeyko Mountains at 2500 m to the slopes of Volcán de Llullaillaco in the Andes at 4500 m above sea level. The profiles indicated that microbial diversity was lowest in samples taken from the core absolute desert region and phylogenetic analysis of one of these samples (987 m) revealed a unique distribution of microogranisms as compared to populations typically found in arid soils. The goal of the current research is to compare the bacterial diversity found in the 987 m sample from the core desert group with that of the driest and least diverse sample from the second group (2547 m) in order to further characterize and compare the effect of ecosystem properties on the microbial community. Both samples were located in areas devoid of vegetation. Biotic and abiotic properties of these samples were evaluated using phylogenetic and multivariate analyses to identify factors influencing microbial community structure and diversity under varying extremes of hyperaridity in the Atacama Desert.

[1] Maier, R.M., *et al.*, (2004) *Science* **306**, 1289-1290. [2] Drees, K.P. *et al.*, (2006) *Appl. Environ. Microbiol.* **72**, 7902-7908.

Zoned columbite-tantalite crystals and late zoned micas from granitic aplite-pegmatite sills of Arcozelo da Serra area (Gouveia, Portugal)

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Granitic aplite-pegmatite sills intruded a granodiorite-granite and a biotite≈muscovite granite from Arcozelo da Serra (Gouveia, central Porugal). The sills were derived from biotite≈muscovite granite magma by fractional crystallization of quartz, plagioclase, potash feldspar and biotite.

Progressively zoned crystals of manganocolumbite show decreases in Nb, Fe contents and increases in W, Ta, U, Zr, Sn, Ti, Sc, Mn, Mg contents and Mn/(Mn+Fe), Ta/(Ta+Nb) ratios from core to rim. In a normal zoning sequence, early Nb-Ta oxides tend toward ferrocolumbite and late ones tend toward Mn-tantalite, because de crystal/melt partition coefficients of Nb and Fe in the oxide minerals are higher than those of Ta and Mn. Reverse zoning is described by: a) decreases in W, Ta, Zr, Sn, Ti, Sc, Fe, Mg, Ta/(Ta+Nb) values versus increase in Nb content from a manganoferrotantalite core to a manganoferrocolumbite rim; b) decreases in Ta, Zr, Cs, Mn, Mg, Mn/(Mn+Fe), Ta/(Ta+Nb) values versus increases in W, Nb, Fe contents from a ferrotantalite core to a ferrocolumbite rim. Reverse zoning is attributed to nucleation and growth of evolved oxide cores and back-reaction of them with the more primitive bulk magma. Oscillatory zoned ferrocolumbite crystals have lighter zones (in backscattered images) containing lower Nb and Fe contents and higher W, Ta, Ti, Sc, Mn, Mg, Mn/(Mn+Fe) and Ta(Ta+Nb) values than darker zones. Oscillatory zonation is mainly due to faster crystal growth than Nb, Ta, Fe and Mn can diffuse through liquid.

Some samples of aplite-pegmatite sills show late zoned micas. The most common zonation consists of a Li-bearing muscovite core and a composition between zinnwaldite and trilithionite for the rim, which is poorer in Al^{vi}, $Al^{iv}+Al^{vi}$, Na, OH and richer in Fe+Mg, Li and F than the core. Apparent oscillatory zoning is defined by alternating late Li-bearing muscovite and a composition between zinnwaldite and trilithionite. Relics of primary muscovite are preserved. In other crystals zinnwaldite replaces Li-bearing muscovite. The late micas show sharp contacts with primary muscovite. They are poorer in Al^{vi}, $Al^{iv}+Al^{vi}$, OH and richer in Fe, Mg, Li, F than primary muscovite and are derived from a melt phase. Late mica compositions show irregular and diffuse contacts. Diffuse requilibration between them was significant.