Microbiology: What is next?

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The overall goal of microbiology is to understand ecology, physiology, evolution and interaction of microorganisms with their environment. Over the last decades the application of molecular-phylogenetic approaches resulted in the discovery of unique and previously unrecognized microorganisms. The vast majority of this unexpected microbial diversity is still inaccessible by a cultivation approach. Here we describe the development of a novel high throughput cultivation method using flow cytometry. This new method allows the rapid cultivation of many so far uncultivated microorganisms. The combination of this novel high throughput cultivation method with recombinant functional screening is an additional step towards the understanding of complex microbial communities.

Experimental determinations of Ar diffusion and solubility in plagioclase and leucite

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Plagioclase feldspar and feldspathoid (leucite and nepheline) minerals are becoming very important in the Ar-Ar dating of volcanic rocks, especially young volcanic systems. Despite the increasing use of plagioclase in Ar-Ar dating, very little is known about its Ar retention properties, and no laboratory derived diffusion parameters are available.

The Ar diffusion parameters for K-feldspar have been known since the early 1970's, and have been confirmed by various techniques, most recently by ultra-violet laser depth profiling. However, very little is known of the diffusion parameters in other feldspars and feldspathoids.

Recent studies have used a new approach to determine Ar diffusion rates, measuring the ingress of ^{36}Ar from carefully controlled laboratory experiments, which has the added advantage of offering combined Ar diffusion and solubility measurements. Studies have been undertaken to measure Ar diffusion and solubility in plagioclases and leucite, yielding information on Ar closure temperatures and diffusion rates, and determining the potential problem of excess Ar influx in these minerals.

Measured Ar diffusion parameters in plagioclase ($E = 26.5 \pm 0.3$ kcal mol^{-1}, $D_o = 8.7 \pm 1.3 \times 10^{-9}$ cm^2 s^{-1}) yield values considerably lower than those for K-feldspar. The lower Ar diffusion rates mean that both grain size and cooling rate have a more pronounced effect on plagioclase closure temperatures than in the K-feldspar system. Plagioclase Ar closure temperatures are a few degrees lower than the equivalent K-feldspar, but in magmatic systems, plagioclase will retain Ar much longer than K-feldspar and this may explain the common observation of older plagioclase grains in volcanic systems.

A separate experiment was undertaken in leucite to determine Ar diffusion and solubility parameters across a known phase transition. Ar solubility in leucite was found to be extremely high, orders of magnitude higher than K-feldspar and plagioclase. The high concentrations of Ar precluded using the ultra-violet laser depth profiling technique, therefore, an electron microprobe was used. 2-dimensional X-ray maps of the Ar distribution in leucite samples were obtained, and the results represent the first images of Ar diffusion in a mineral.