Cosmogenic nuclide intercalibration and erosion rate study on fault scarps of the Bishop Tuff, CA, USA

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The Bishop Tuff in eastern California is a welded ignimbrite deposit that erupted 760 ± 2ka ago from the Long Valley Caldera, as dated with ^{40}Ar/^{39}Ar on sanidines [1]. Surface samples from the Bishop Tuff were collected for comparing the production rates of cosmogenic nuclides (^{3}He, ^{21}Ne, ^{10}Be, ^{26}Al) in various minerals available in the sampled ignimbrite unit, like quartz, pyroxene, magnetite and sanidine. Although the Bishop Tuff has experienced erosion and absolute calibration is thus not possible, still production rate ratios can be assessed. So far, 20 samples have been analyzed for the ^{21}Ne concentration in quartz. For one of those samples, ^{3}He and ^{21}Ne have been determined in coexisting clino- and orthopyroxene. The concentrations of cosmogenic ^{3}He are difficult to assess due to possible contributions of both magmatic and nucleogenic ^{3}He. However, the ratios of cosmogenic ^{21}Ne(cpx)/^{21}Ne(qz) and ^{21}Ne(opx)/^{21}Ne(qz) are ~1.23 and ~1.45 respectively. In comparison, using the elemental production rates of Kober *et al*. (2005) [2], would imply ratios of ^{21}Ne (px)/^{21}Ne(qz) 1.38 (cpx) and 1.50 (opx) for the chemical composition of these analysed pyroxenes. In the near future we would also like to determine the production rate ratios ^{21}Ne/^{10}Be and ^{21}Ne/^{26}Al in the same quartz samples.

In addition to the production rate nuclide intercalibration, we performed an erosion rate study at the Bishop Tuff. We sampled the footwalls of 3 normal fault scarps, extending from the fault center to the tapering end, that run N-S through the SW of the Bishop Tuff due to tectonic extension of the area. 18 preliminary exposure ages – calculated from ^{21}Ne concentrations in quartz – range from 260 to 505 ka, i.e. ~35 – 70 percent lower than the eruption age of the Bishop Tuff. The discrepancy shows that about 1.0 to 1.8 m of material has been removed since the eruption. The ^{21}Ne ages vary rather systematically with the oldest ages mostly at the tapering ends of the scarps and the youngest ages at the fault centers where the vertical displacement is maximal. As the faults are active and they propagate [3] our data indicates that the process of erosion is more pronounced on the fault centers compared to the lower fault tips. In general, ages from bedrock samples (n = 14) show more variation than desert pavement samples (n = 4).

References

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Crystal orientation selection during growth of brachiopod shell calcite

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The progresses in the technique of electron backscatter diffraction (EBSD) in combination with SEM provides an ideal set of imaging and diffraction methods to reveal the architecture of calcitic brachiopod shells. Usually calcitic brachiopods show a two-layered shell with a hard nanocrystalline primary layer and a fibrous secondary layer where the fibers are single crystals with the morphological fiber axis perpendicular to the crystallographic c-axis.

The investigated species, *Kakanuiella chathamensis* and *Liothyrella neozelanica* differ from this assembly: the former one is built entirely of hard nano- to microcrystalline calcite whereas the latter one shows a usuall primary layer, but a secondary layer which is prismatic and a fibrous tertiary layer.

Our observations on the interface between the primary and the secondary layer in *L. neozelanica* suggest a mechanism how the unusual crystallographic texture may arise.

Even though *Kakanuiella chathamensis* consists only of primary layer material we observe some textural features and a pattern in the distribution of hardness within the shell.

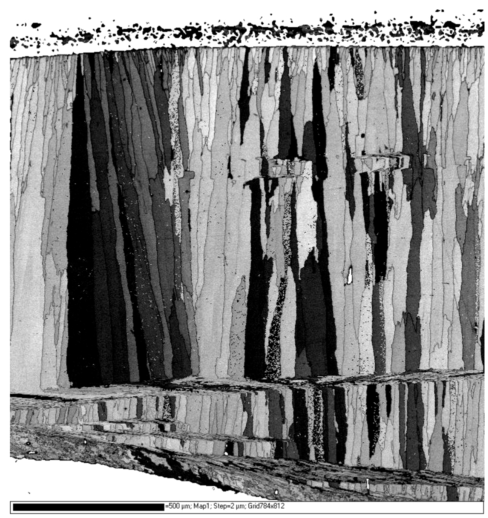

Figure 1: EBSD-Map of the three layered shell of *L. neozelanica* (black bar down left: 500 µm).

References

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