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$\delta^{13}C$, $\delta^{18}O$ and tree ring widths as climate proxies in the Karakorum (Pakistan)

K. Treydte[1,2,3], G.H. Schleser[2] and M. Winiger[3]

[1] Swiss Federal Research Institute WSL, Zuercherstrasse 111, 8903 Birmensdorf, Switzerland;
e-mail: kerstin.treydte@wsl.ch

[2] Research Centre Juelich FZJ, Institute for Sedimentary Systems ICG V, Leo-Brandt-Str., D-52425 Juelich, Germany

[3] University of Bonn, Institute for Geography, Meckenheimer Allee 166, D-53115 Bonn, Germany

Presently, millenia-legnth climate reconstructions with annual resolution are mostly based on tree ring width and density. There exist no studies on decadal and centennial climatic signals of stable isotopes in tree rings despite of many promising high frequency calibration results.
The aim of the project is the finding of recent and the reconstruction of past climate variations by using $\delta^{13}C$ and $\delta^{18}O$ of *juniperus spec*. in the Karakorum Mountains/Pakistan. The region is climatically situated at the interface between monsoon circulation and westerlies.
At four sites along horizontal and vertical gradients of temperature and precipitation relationships between $\delta^{13}C$, $\delta^{18}O$ (cellulose) and tree ring width as well as inter site correlations of the three parameters are investigated for the period AD 1900-1998. Site comparisons show a dependency of ring width records on ecological conditions. This correlation is reduced for the carbon records, and disappears for the oxygen records, i.e. the latter are highly similar regardless of site conditions. That points to the influence of an overregional external factor, which masks site dependent and plant physiological influences. First calibration results show high correlations of the oxygen records with winter precipitation.
At one cold and dry upper timberline site, millennia-length isotope records have been prepared. They show no individual age-trends, as they are known from tree ring width records. Therefore low frequency variations preserved in the raw measurements of our isotope records are more directly interpretable in relation to climate variability, especially when focussing on periods like the Mediaeval Warm Period and the transition to the Little Ice Age. On the other hand, atmospheric CO_2 changes due to anthropogenic influences starting at the beginning of the 19th century and masking low frequency climatic signals, hamper calibration calculations. Further investigations aim to combine the three tree ring parameters with their specific advantages to a detailed climate reconstruction including temperature *and* precipitation.