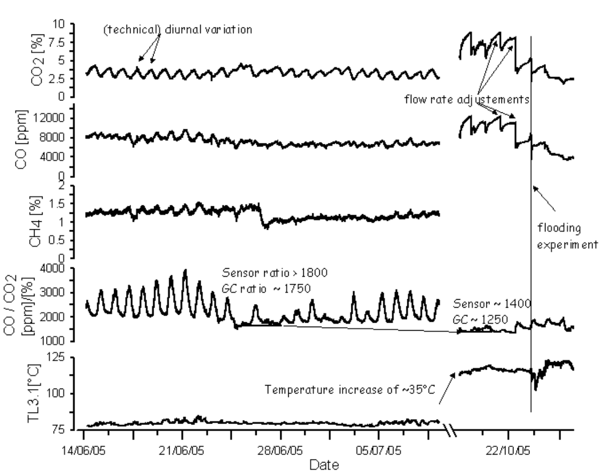
Combustion gases of coal fires – Composition and interpretation

STEFAN SCHLOEMER* AND MANFRED TESCHNER

Federal Institute for Geosciences and Natural Resources Hannover, Germany
(*correspondence s.schloemer@bgr.de)

In the Inner Mongolia Autonomous Region (PRC), an area of 280.000 m² is affected by subsurface coal fires. Besides economic damages coal fires cause land subsidence and affect the human health in nearby areas. Enormous quantities of noxious gases and particulate matter can be emitted to the atmosphere, condensation products can lead to water and soil pollution. Combustion gases analysis of fire zones revealed various combustion processes. Occurrence of CH_4 and CO can be linked to coal pyrolysis (heating in the absence of oxygen or any other reagents) and molecular hydrogen results from coking, i.e. the generation of volatile constituents or coal gasification processes (conversion of carbonaceous materials into CO and H_2).

Combustion gases and temperatures of *in situ* coal fires have been measured continuously (30s intervals) close to the main combustion zone (~25m) at one of the largest fire zones in this area. Temperature measurements in cracks showed intense fluctuations (up to ±100°C within 48h) which could not be directly related to meteorological conditions. These short-term fluctuations were superimposed by long-term temperature trends. The rate of temperature changes over the entire measuring period ranged from +100°C/month to -30°C/month. These variations are a result of the proceeding fire front and are confirmed by the change in gas composition. Over the measuring period the CO/CO_2 ratio significantly decreased. At the same time the temperature of the sampled vent increased by 35°C (80°C -> 115°C). Both findings indicate the approach of the main combustion zone. The observed trends are smaller than expected and suggest a very slow progress of the subsurface coal fire (< 10m/year).



Nb/Ta systematics of orogenic eclogites

A. SCHMIDT[1]*, S. WEYER[1], T. JOHN[2] AND G.P. BREY[1]

[1]Institut für Geowissenschaften, Universität Frankfurt, Germany
(*correspondence: alexander.schmidt@em.uni-frankfurt.de)
[2]Physics of Geological Processes, University Oslo, Norway

The depleted mantle and the continental crust are thought to balance the budget of refractory and lithophile elements in the Bulk Silicate Earth (BSE), resulting in complementary trace element patterns of these reservoirs. However, the two high field strength elements (HFSE) Nb and Ta appear to contradict this mass balance. All reservoirs of the BSE exhibit Nb/Ta ratios distinctly lower than the chondritic ratio of $\approx$ 20 [1]. Explanations for this finding may be the incorporation of Nb into the Earth's core [2] or an eclogitic reservoir in the mantle with superchondritic Nb/Ta ratios [3]. In this study a series of eclogites from different orogenic belts was analyzed to determine their HFSE concentrations and to contribute to the question of whether eclogites could form a hidden reservoir, which may account for the mass imbalance of the BSE. The results show that orogenic eclogites have subchondritic Nb/Ta ratios (on average 14.9) and near chondritic Zr/Hf ratios. The investigated eclogites show no fractionation of Nb/Ta ratios and no enrichment of Nb compared to MORB, the likely precursor of these rocks. Rutiles contain about 90% of the Nb and Ta budget in eclogites. For mass balance reasons their Nb/Ta ratios must be ± identical to those of the bulk eclogite. However, LA-ICPMS analyses of rutiles in these eclogites reveal distinct zonations of the Nb/Ta ratios, with cores having higher Nb/Ta than rims. Consequently, Laser Ablation data of rutiles have to be evaluated carefully, when using them for the determination of the bulk eclogite Nb/Ta. Our results demonstrate that eclogites can not balance the differences in Nb/Ta between BSE and chondrite. Additionally, they are also unlikely to account for the possibly lower Nb/Ta of the continental crust, which may instead be inherited from the depleted lithospheric mantle [4]. Our results also show that rutile is not responsible for a fractionation of Nb and Ta, nor for a selective retention of these elements in the subducted slab. These findings support the theory that the subchondritic Nb/Ta of the BSE is best explained by the incorporation of Nb into the Earth´s core under high pressures [2].

[1] Münker *et al.* (2003) *Science* **301**, 84-87 [2] Wade & Wood (2001) *Nature* **409**, 75-78 [3] Rudnick *et al.* (2000) *Science* **287**, 278-281 [4] Weyer *et al.* (2003) *EPSL* **205**, 309-324