Mineralogical study of arsenic carrier in coal combustion by-products of Kyjov-Poša impoundment (Slovakia)

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The annual production of the coal combustion by-products (hereinafter CCB's) plays widely significant role as the anthropogenic arsenic resource [1, 2].

Previous research in the Kyjov-Poša locality well identified impoundment itself as the source of numerous organic and inorganic pollutants [3, 4, 5]. Downstream aquatic system which receives CCB's storage leachate contains elevated concentration of As exceeding the maximal allowed concentration for ground water after governmental regulation 296/2005 (<0.03 mg/l, Slovak Republic).

CCB's deposit stores circa 4.25 milion tons of ash with average As content 461 mg/kg (34 samples), thus 1960 tons of As in total.

The present study clarify As pathways after brown coal burning through storage deposit into the aquatic system. Realgar and orpiment rich coal after desulfurization in high-pressure boilers create As_2O_3 (gas?) as the main As (III) carrier that precipitate on the CCB's particle surfaces in the form of arsenolite and claudetite. Moreover, it is observed that arsenic oxidation state changes from tri-valent to penta-valent form linked with arseniosiderite crystalization. Solubility of arsenolite and claudetite in water seems to be dominant controlling factor of the arsenic mobility in studied site.

[1] Henke (2009) Willey, 291-297. [2] Reinmann *et al*. (2009) *Appl Geochem* **24**, 1147-1167. [3] Hiller *et al*. (2009) *Appl Geochem* **24**, 2175–2185. [4] Hiller *et al*. (2009) *J. Hydro. Hydromech* **57**, 3, 200–211. [5] Jurkovič *et al*. (2006) *Slov. geol. mag* **12**, 1, 31–38.

Mixed-habit diamonds: Evidence of a specific mantle fluid chemistry?

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Mixed-habit diamonds are a relatively understudied subset of samples, considering the amount of research that has been carried out on these vessels from the mantle. They exhibit periods of growth during which they were bound by two surface forms [1]; smooth octahedral facets, along with hummocky, non-facetted "cuboid" surfaces whose mean orientation is {100} [2]. This type of diamond is commonly referred to as *star* or *centre-cross*, because the cuboid sectors have a much darker appearance due to abundant graphite inclusions (Figure 1). However, for unknown reasons, cuboid sectors do not always contain these graphite inclusions. This means that occurrence of this type of diamond is likely under-reported simply as it is not always visible.

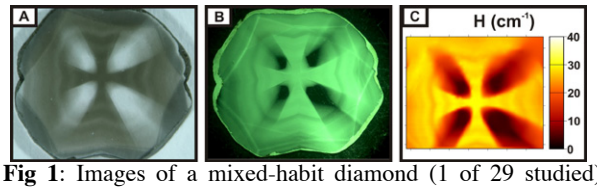

Fig 1: Images of a mixed-habit diamond (1 of 29 studied), under (A) visible light, (B) UV, & (C) IR map showing H concentration.

Mixed-habit diamonds have a number of unique characteristics (i) high nitrogen concentrations in both O and C sectors (higher in O than C), (ii) high hydrogen concentrations in the C sectors only (iii) low levels of nitrogen aggregation (iv) anomalously low platelet concentrations in the C sectors (v) vivid green CL that highlights an extremely complex growth history. We present a study that utilizes a holistic analytical approach (IR mapping, CL imaging, CL spectroscopy, SIMS C-isotope, Raman, EBSD) to identify all of these unique characteristics and understand them within the context of diamond growth. This will provide insights into the chemistry of the mantle fluids involved in this type of diamond growth.

[1] Frank (1967) *Proc. Int. Industrial Diamond Conf.*, 119-135. [2] Lang (1974) *Proc. R. Soc. Lond.*, ***A*. 340**, 233-248.