

Chemical composition of biomass used in co-combustion with coal in Polish power-plants

W. WILCZYŃSKA-MICHALIK^{1*}, R. GASEK¹ AND M. MICHALIK²

¹Institute of Geography, Pedagogical University, ul.

Podchorążych 2, 30-085 Kraków, Poland

(*correspondence: wmichali@up.krakow.pl;
rgasek@ap.krakow.pl)

²Institute of Geological Sciences, Jagiellonian University, ul.

Oleandry 2a, 30-063 Kraków, Poland;
(marek.michalik@uj.edu.pl)

Biomass is considered as important non-fossil renewable energy source. Potential biomass resources in Poland are estimated to be around 30 millions Mg per year and the share of biomass in electricity production and other applications is increasing systematically. Lack of complex life cycle assessment studies is the reason that real environmental value of biomass usage as fuel is not fully understood.

Concentration of major and trace elements in biomass is very important in prediction of technological problems during combustion and usage of combustion co-products as well as their environmental impact. Composition of biomass is related to many factors, e.g.: type of biomass, age of plant, growth process, fertilizers and pesticides used, soils composition and contamination, atmospheric pollution of plantation area, harvesting, transportation and storage.

The study is based mineralogical (optical and electron microscopy, XRD) and chemical analyses of samples of biomass used in power-plants in southern Poland.

The content of mineral component is low. Mineral particles can be considered as detrital (i.e. introduced by water or wind during plant growth) and anthropogenic (introduced during harvesting, transportation, storage and processing).

Chemical variation of studied samples of biomass is significant (e.g. Ca from 0.1 to 1.1wt%; P from 0.2 to 0.89wt%; Al from <0.01 to 0.09wt%; Na from <0.001 to 0.106wt%; K from 0.05 to 2.4wt%; S from <0.01 to 0.22wt% and for selected trace elements: Mn from 7 to 333 ppm; Pb from 2.9 to 25.6 ppm; Zn from 8.3 to 79.4 ppm; Cu from 2.2 to 25.2 ppm; Mo from 0.03 to 0.72 ppm; Hg from <1 to 21 ppb). The content of several trace elements is within the range comparable with Polish coals (e.g. Mn, Cr, Cu, Ni, Pb, Zn).

Significant differences in chemical composition of various types of biomass suggest that it is possible to expect different behaviour during combustion and different environmental impact. It also suggests that careful blending of biomass may be important.

Hydrothermal alteration and Ni sulphide formation in the Bon Accord Ni-oxide body, Barberton, South Africa

ANTJE WILDAU^{1*}, A.E. WILLIAMS-JONES² AND MARIAN TREDOUX¹

¹Department of Geology, University of the Free State, Bloemfontein, 9300, South Africa

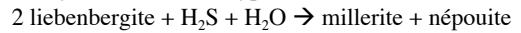
(*correspondence: antje@geologie-leipzig.de)

²Department of Earth and Planetary Sciences, McGill University, Montreal, QC, H3A 2A7, Canada

The Bon Accord deposit is a 3.5Ga Ni-oxide body in the Barberton Greenstone Belt, South Africa. This small, lens-shaped orebody (6 x 3 x 0.35 m) was discovered in 1920, and mined out in the 1960s. The Ni concentration ranged from 35wt.% NiO in the center to 10wt.% NiO at the rim. The deposit has attracted considerable attention because of its very unusual mineralogy (e.g., bonaccordite, cochromite, nimite, liebenbergite, willemseite, trevorite). The orebody is hosted by a talc-carbonate-serpentinite and is located in the contact metamorphic aureole of a younger granite. The genesis of the deposit is unknown and the two main hypotheses that have been advanced for its formation are controversial. One of these is that the deposit is the product of a meteorite impact and the other is that it is an oxidized body of nickel-iron from the Earth's core.

Petrographic and geochemical studies of the Bon Accord deposit show the influence of hydrothermal fluids. In the centre of the deposit, there are relicts of primary liebenbergite (Ni_2SiO_4), which was serpentized and later altered to willemseite ($(\text{Ni},\text{Mg})_3\text{Si}_4\text{O}_{10}(\text{OH})_2$). The rest of the orebody is completely devoid of liebenbergite (Ni_2SiO_4) but much richer in népouite ($\text{Ni}_3\text{Si}_2\text{O}_5(\text{OH})_4$) and willemseite ($(\text{Ni},\text{Mg})_3\text{Si}_4\text{O}_{10}(\text{OH})_2$). The outer parts contain abundant millerite (NiS) and heazlewoodite (Ni_3S_2), plus a number of Ni-arsenide and Cu-sulphide minerals (10 vol.%), whereas the centre is almost devoid of Ni-sulphide minerals (<1vol.%). These minerals occupy cracks in the ferroan trevorite (NiFe_2O_4) and nickelian magnetite ($(\text{Ni},\text{Fe})_3\text{O}_4$). In some places, the secondary minerals replace these oxides.

The mineralogical and textural relationships described above are consistent with alteration of the primary silicate minerals by reactions of the type:



These observations suggest that the Bon Accord deposit formed from Ni-rich komatiite that was altered by circulating hydrothermal fluids, forming secondary sulphide minerals.