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MODES OF OCCURRENCE OF RARE EARTH ELEMENTS IN PEAT FROM WESTERN SIBERIA

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Abstract

Selective leaching of rare earth elements (REE) from peat samples from Western Siberia indicates unanticipated modes of occurrence. It has been determined that from 40 to 80 % of the total REE in the peat is accounted for in the hydrolyzable and water-soluble substances, 10-30% of the REE is concentrated in humic acids. Minerals in peat play a minor role in the accumulation of REE. In general, no more than 25% of REE is accounted for in mineral association. Among the mineral forms of REE in peat, clastogenic phosphates (monazite, xenotime, crandallite group) and zircon are the dominant hosts. REE are distributed in different phases of the peat: the water-soluble and hydrolyzable substances are relatively enriched in light REE, and humic substances are enriched in heavy REE.

Key words:

Peat, rare earth elements, modes of occurrence, conditions of peat formation

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Introduction

The modes of occurrence of chemical elements in peat are important indicators of deposit formation and the nature of low temperature geochemical processes. They are also useful for determining the accumulation conditions of trace elements in coals resulting from the peats.

Unlike coals, the modes of occurrence of rare earth elements (REE) in peat have not been studied extensively. Existing information is rare and is generally related to the upper part of peat deposits, which is called the peat-forming or active layer. In this horizon active processes of the organic matter transformation occur, including bacterial activity. Oxygen is present in sufficient quantity and therefore the environment is oxidative, unlike the whole peat deposit (Rakovsky and Pigulevskaya, 1978; Shotykh, 1992; Savichev, 2015; Savichev et al., 2016).

In contrast to the peats, the modes of occurrence of REE have been studied in detail in soils of different composition, including waterlogged soils (Mihailovic et al., 2014; Davranche et al., 2016). The results of the soil research are often applied to peat as the soils can be considered as peat analogues. However, the physical-chemical properties of the lower peat-forming layers differ considerably from soils of any composition, including waterlogged soils (wetland and paddy soils). The main differences between soils and the lower peat layers are the anaerobic regimes with low oxygen activity, high concentrations of organic substances and low microbial activity in the peatlands. Unlike soils, metals in peatlands are present in the reduced state, often in the native mode (Smieja-Król et al., 2010). In soils, individual REE can oxidize to the 4+ valence state and form Ce/Ce* anomalies (Cao et al., 2001; Compton et al., 2003, Davranche et al., 2016), where Ce* is a theoretical mean Ce content, calculated from

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