



Formation, classification and properties of soils at two relict charcoal hearth sites in Brandenburg, Germany

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Historical charcoal production can have significant effects on the properties of soils. We studied soils at former charcoal production sites (relict charcoal hearths, RCHs) and compared these soils with an undisturbed soil next to the charcoal hearths and four representative soils located at distances between 10 to 70 km from the studied RCHs. In a landscape typical of the Northern German Lowland, we found Podsol Braunerde (WRB: Brunic Arenosols (Protosodic)) outside of the RCHs and soils with a clearly different stratigraphy within the RCHs. The main feature of the soils in both of the studied RCHs is a heterogeneous, charcoal-bearing deposit that is approximately 30 cm thick. No indications of translocation or mineral transformation processes forming distinct soil horizons after the deposition of the anthropogenic material on the RCHs are present. Except for the differences in color and the total carbon content, the soil chemistry of the RCHs hardly differs from that of the soil outside of the charcoal hearth sites. The soil colors and magnetic susceptibility values strongly suggest that the RCH substrates and the underlying topsoil were affected by thermally induced transformation of iron (hydr-)oxides. Although the charring procedure normally requires about two weeks, the heating effect only reaches a maximum depth of 8 cm into the buried soil below the charcoal hearths. The presence of reddish soil and an abrupt increase in magnetic susceptibility in the upper 2 cm of the soil below the charcoal hearths indicate heat-induced transformation of iron (hydr-)oxides into maghemite. Brighter soil color and an increase in the soil organic matter in the lower parts of the buried topsoil demonstrate the incineration of soil organic matter up to this depth. According to the German Guidelines for Soil Mapping, the soils in the RCHs are classified as Regosols above Braunerde (WRB: Spolic Technosols (Arenic)). However, because the anthropogenic features of these soil sediments are disregarded in the German Guidelines for Soil Mapping, we suggest adapting the 'M' horizon to permit a jM horizon. Thus, the soils in the RCHs could be classified as Kolluviale Braunerde. The worldwide distribution of RCHs in different climates and the presence of different iron(hydr-)oxides and carbon compounds, together with the possibility of dating RCHs using dendrochronology, emphasizes the potential of these sites for further pedological studies.