Journal of Water and Soil
Vol. 30, No. 3, Jul.-Agu. 2017, p. 863-873

نشریه آب و خاک (علوم و صنایع کشاورزی)
جلد ۳۰، شماره ۳، مرداد – شهریور ۱۳۹۶، ص. ۸۷۳-۸۶۳

Micromorphological and Mineralogical Assessment of Suteh Peat Swamp Forest, Golestan Province

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Received: 04-05-2016
Accepted: 24-01-2017

Introduction: Peat is an organic soil which is formed by the accumulation of decayed vegetative matter that have formed in areas of poor water drainage. The mineral components of peat are derived from inorganic matter contained in sediments and by adsorption from groundwater. The inorganic (mineral) fraction of peat usually includes only 2–10 Percent of its dry weight, but for highly decomposed peats can increase to about 60 percent of dry weight. Thin sections of peat reveal detailed information of composition, structure, fabric and particularly pore properties which influence water retention and movement. Peat is a concentrated form of soil organic matter which has environmental, industrial, agricultural and medical uses that range from sustaining the productive capacity of agricultural land. This study has been focused on micromorphological and mineralogical properties of Suteh peat swamp forest (PSF) in Golestan province, north of Iran. Golestan province is the third largest cereal producer in Iran but scarcity of water and salinity are most important major problems in this area. This area has been covered by almost 400,000 hectares of forests. Suteh PSF has been chosen as a swamp that contains organic and inorganic matters. As the inorganic composition of peat varies considerably from region to region, study of mineralogical and micromorphological of Suteh PSF can be useful in order to identification of Golestan province peat swamps. Since the early 1990s, micromorphological studies have become increasingly popular in the analysis of lakeside settlements. The evaluation of soils considers thin-section observations, macromorphological features, and laboratory data. Micromorphological analyses allow the characterization of natural and anthropogenic sediments, which in turn enables the determination of sedimentary processes and depositional environment.

Materials and Methods: This study was carried out in April 2014. The samples were collected from zero to 40 cm depth of swamp areas, within a 10 cm radius. At each sampling station, peat samples were collected with a trowel. The area included the north side of the Alborz Mountains and extended northward to the township of Gorgan. The altitude was approximately 950–2000 m a.s.l. According to the Gorgan Natural Resources Bureau report, Suteh is temperate to semi-arid on the Emberger climate diagram. To achieve the purpose, samples were dried and prepared based on standard methods. These studies were carried out using polarized microscope on thin sections and polished section at the Mineralogy Laboratory of the Amirkabir University of Technology.To prepare thin sections for microscopy studies, samples with polyester, cobalt oxide and hardener have been combined. Polyester formed the matrix of the section and hardener ($HCl + H^2O_2$) has been used to reduce a hard time getting. Cobalt oxide has been used as a catalyst between them. The samples have been kept tight in special containers. Due to the presence of organic matter, much time was needed to harden them. The samples were dried and tightened for 20 days. Then, the samples were polished by various polishers (No. 400, 600, 800, 1000 and 2000). After that, they were polished for 20 minutes by the suspension of alumina ($Al_2O_3 + H_2O$).

Results and Discussion: The coarse material that formed groundmass were composed of quartz, muscovite, orthoclase, calcite, opacity pyroxene biotite and opaque minerals. Some flakes of muscovite, pyroxene and biotite showed weathering. Fe–Mn components were most common in opaque minerals. Quartz crystals were seen in abundance in most sections. Weathered surface of orthoclase was seen in some sections. The large biotite crystals were seen at different sections with pleochroism light brown to dark brown. Root and other organ residues in varieties states of decomposition were observed in some sections. Fragments of organ and tissue residues were rather few and found mostly in the surface of Suteh PSF. For detailed assessment of opaque minerals, one of the grains was selected and analyzed. The weathering of minerals showed the normal stability trend, i.e. quartz >muscovite>biotite. Biotite loses its pleochroism and alters first to a mica-vermiculite interstratified clay mineral. Polished sections study showed Fe components were the major and dominate in the sections.

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Conclusions: Thin sections results showed the samples contained quartz, orthoclase, muscovite, biotite, calcite, opacity pyroxene and opaque minerals. Polished sections results revealed that Fe components were most common in opaque minerals in the sections. Micromorphological study showed root and other organ residues in Suteh PSF that this showed this soil composed of a mixture of organ residues and organic material.

Keywords: Micromorphology, Mineralogy, Organic soil, Suteh Peat Swamp Forest