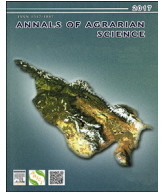




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Peculiarities of red color soils introduced in the Red Book of the Soils of Georgia

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ABSTRACT

The article reviews the peculiarities of red color soils that are distributed in West Georgia. Objectives for the research are Red soils and Terra Rossa soils. From red color soils that occur in humid subtropical zone one is well-studied Red soil and another is Terra Rossa that are distributed fragmentally and are formed on carbonate parent materials. In general, Red soils by morphological and genesis approaches of WRB system correspond to reference soil group of Ferrasols that have principal qualifier Stagnic. Terra Rossa belongs to the group of Leptosols according to the same international classification system. Due to formation on carbonate rocks it has the principal qualifier Rendzic. Because of a red color and the level of a base saturation, other qualifiers are: Brunic and Eutric. Red soils belong to “Standard” and Terra Rossa to “Rare” groups of Red Book of the Soils of Georgia.

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Introduction

Georgia is well-known by variety of soil cover, therefore, the study of its pedosphere had always been a great concern for soil scientists, among them should be noted the founder of the soil science V. V. Dokuchaev, who called Georgia “a open-air museum of soils”.

In recent years, for integration of the soils of Georgia in the international pedogenic world, surveys are being held including correlation of the soils of Georgia with the World Reference Base for Soil Resources (WRB) system [1–3].

For Georgia, as a small country, it is crucial to popularize and protect its soil resources, that will be supported through creation of the Red Book of the Soils of Georgia [4,5]. Recognition and allocation of the research objects to the groups of the book can be used to plan soil protection measures and improve structure of agricultural land use practices.

Creation of the Red Book of the Soils of Georgia was financially

supported by Shota Rustaveli National Science Foundation of Georgia (Applied research grant 2016, agreement #AR 216726). In frame of the research red color soils have been studied that were allocated to the “Rare” and “Standard” soil groups.

Red color soils occur in West Georgia. Namely by national classification: Red soils and Terra Rossa soils.

Red soil belongs to one of soil types of humid subtropical zone of West Georgia, protection of which facilitates preservation and conservation of the ecosystem of the its area. Respectively this type of soil belongs to the standard group.

Red soils are the main soil types of the humid subtropical zone in which the peculiarities of the bio-climate zone are clearly reflected. Researchers separate three main subtypes of the Red soil on the territory of Georgia [6]: 1) Typical e.g. non-differentiated profile; 2) With differentiated profile e.g. lesivated and 3) Weakly developed. The typical Red soils mostly occur in Adjara, Guria and Abkhazia regions of the country, that are formed on the deep crust of weathering. Red soils are formed on the ferralite weathering crust and often inherit composition that is characterized for them. In humid subtropics the soil is separated from the weathering crust, the boundaries are uncertain and their overall thickness exceeds hundreds of meters.

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Red soils belong to well-studied soil types [7–10]. They are widely distributed in the south-west part of humid subtropical zone of the country, at altitudes of 100–300 m above sea level, on hilly terrains [11,12].

Red soil formation processes can be defined as an on-going processes on Ferralite or Ferralitized weathering crust. For humid and relatively warm subtropical territories of Red soils develop on weathering crust with different levels of Ferralitization. Dokuchaev used to call them “Laterite of Batumi (city in west Georgia)”. Later, researchers named them as “Red soil”, more often as - “Red crust of weathering” [13] and “Red-podzol soil” [14].

Under the “Ferralite weathering crust” that is typical for humid subtropics of West Georgia, is implied relatively thick, clay substance, surface formation of which keeps (fully or partially) the structural composition of the primary rock, significantly enriched with oxide and hydroxide of Fe and contains less amount of Al. Heterogeneity of the initial rocks and denudation processes determine the moving and redeposition of weathering material for a long period of time. Horizons of the crust contain primary minerals, that decide ferrallitic, ferralitized and fersiallitic nature of weathering crust in West Georgia [6]. Ferralite weathering crust distribution is observed in Adjara and Guria (Ozurgeti) regions. So-called “zebra-like” clay weathering crust is widely distributed in village Anaseuli, clay minerals of which are: kaolinite, hydrochlorite minerals and hydrous micas and R_2O_3 . The age of ferrallitic crust of west Georgia is not precisely determined. Some researchers believe that it is from tertiary period [15,16], for others it's quaternary period [17,18]. The weathering crust of west Georgia is soil-formation rock. Peculiarities of its mineral composition, texture and structure determine the intensity of soil formation in a relatively short period of time, at big depths. Consequently, it is estimated that the speed of the soil formation is significantly higher on weathering crust than on other rocks [6].

Red color soil named Terra Rossa belong to the rare group of the Red Book of the Soils of Georgia. Because of red color, they are united in Laterite or belong to those zones of soil, where they occur. Red color soils are formed in warm and humid climate conditions. It is considered that in formation of Terra Rossa the crucial importance stands on climate factor and not on the nature of parent material [19]. Such soils often misleadingly are called Red soils. Their red color comes from high iron content and at the same time the soil contains calcium carbonate. Georgian scientists consider, that red-color soil developed on carbonate rocks are the sub-type of Raw carbonate soils and are known as “Terra Rossa” [19,20]. The red-color soils are called Rendzic-red soils, that are distributed fragmentally in west Georgian zone of Raw carbonate soils on limestones (Sokhumi, Akhali Athoni, Tsageri, Ambrolauri and Tki-buli cities) [21]. Because of limited area of distribution and original profile, these soils belong to the rare group. The soils have reddish-brown or raspberry color because of high content of iron.

Formation process for the red color soils are in conditions of contrast rotation of humid and hot, dry seasons. The most important soil formation factor is carbonate parent material. Red color of the soil can be referred to the process of rubification. Drying out of the soil in a dry season determines the dehydration of iron oxides because of that iron compounds are going under special change and morphologically the process is expressed in colorization of the soil profile into red color. In the depth of the profile the red colored particles move by abundant rainfall, therefore limestones even in deep layers are colored in red.

Objectives and methods

Red soil and Terra Rossa were selected as target objects for the research. Field researches were conducted according to WRB

standards [2,22,23]. The correlation of the soils with WRB system soil reference groups was implemented on the basis of the genesis approach. In the laboratory we analysed: particle size distribution (by pipette methods); actual soil acidity in water extract 1:2.5, exchangeable acidity by 1 M KCl extract, humus content (by wet combustion method), exchangeable bases (by 0.1M HCl); hydrolytic acidity (by NH_4COOH at pH 8.2). The cation exchange capacity was defined as sum of exchangeable cations and hydrolytic acidity by Gedroitse method [24]. The carbonate content was determined by the Scheibler method. All data were analysed on the basis of methods recommended by the WRB.

Results and discussion

There were selected two profiles of red color soils for the Red Book of the Soils of Georgia: 1. In Ozurgeti Red soil that is formed on zebra-like clays (Fig. 1). Terra Rossa that occur on limestone in Sataplia (Fig. 2).

Morphological description of the Red soil:

Location: Ozurgeti, Anaseuli.

Altitude: 107 m.

Landform and topography (relief): Upper part of slope.



Fig. 1. Red soil (Anaseuli).

A – 0–30 cm - 7,5YR3/2,5, loamy, moist, crumbly, many roots.

B₁ – 30–60 cm - 2,5YR45/7, moist, loamy, crumbly, lot of roots.

B₂ – 60–85 cm - 2,5YR45/8, moist, loamy, crumbly, Iron mottles (10YR3/6).

CD₁ – 85–100 cm - 5YR5/7, moist, loamy, abundant of Iron mottles (10 YR3/6) and very light coloured mottles (2,5YR7,5/1).

CD₂ – 103–120 cm, 5YR5/7, moist, motley, loamy, no roots, abundant iron mottles (10YR3/6) and light mottles (2,5YR7,5/1).

The soil has no effervescence with 10% HCL.

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