DIVERSITY AND SYSTEMATIZATION OF SOILS

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Keywords: soil diversity, soil cover, classification of soils, a type of soil, geography of soils, soil maps, FAO, World Reference Base for soil resources, reference groups of soils, biodiversity

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Summary

The diversity soils in the "soil kingdom" as natural material media is determined by many factors of their origin and great variety of combinations of the soil-forming factors. Soil bodies of different thickness, color, structure, etc., comprise the Earth's pedosphere. Soil diversity is also increased by the influence of the anthropogenic factors of soil formation.

The totality of all soils and soil-like bodies forms a soil cover of the Earth. It is shown on soil maps and described by soil classifications. The soil classifications are sown with a system of central images, formed in national institutions of soil sciences. International classification of soils, created in the second half of XX century, describes the whole totality of soils on the Globe, based on the integrated experience of national bodies as well as by means of an agreed upon nomenclature. The whole totality of soils is divided into 32 generalizing taxa (Reference Groups) on the basis of their main properties and genesis. The World Reference Base of soil resources is the basic language of the soil sciences, which allows scientific association and contacts as well as translation of the soil information into different languages.

The soil is a planetary niche of ecological connections, providing interaction and unity of the biosphere components and creating conditions for sustaining the biodiversity on the Earth.

1. Introduction: Diversity of Factors is the Diversity of Soil Characteristics

Soil is formed on the Earth's surface that is in that part of the biosphere where three geospheres, -the atmosphere, hydrosphere, and lithosphere-mutually join and penetrate into one another. This is an area where the density of living substance of the planet

reaches its maximal value. The soil is a natural body, which like a mirror reflects links between organic and inorganic matter, thus becoming a “mirror of landscape” (a term coined by V.V. Dokuchaev (1846-1903) who was a founder of the soil science).

The multy-factoricity of soils origin and infinity of diversity of soil-forming agents combinations determine the great variety in the pedosphere. Profiles of some tundra soils or of soils on slowly decaying dense rocks amount to only a few tens of centimeters while in the tropics, on the thick crust weathered by the soil formation processes, stretch down to tens of meters. Different minerals and organic substances give soils various colors. They can be cold blue-gray, gray-green, bluish, and olive-like colors, all hues of brown and gray to black ones, red and yellow bright hues of minerals of iron, white color of peeled granules of silicates and clusters of crystals of salts. Thus, for example, Fig. 1 shows the profile *Ferralsol* soil, colored bright red due to large amounts of the iron oxides. Soil profiles are divided into horizons with various structures, densities, and porosities. Structural soil separations of upper horizons of fertile soils appear like dense grains of cereals or round beads hanging on roots. Middle horizons disintegrate into plates, lumps, prisms, columnar aggregates, and others. In some soils, materials of horizons are free-flowing or fall apart particles as dust particles at the slightest mechanical impact.

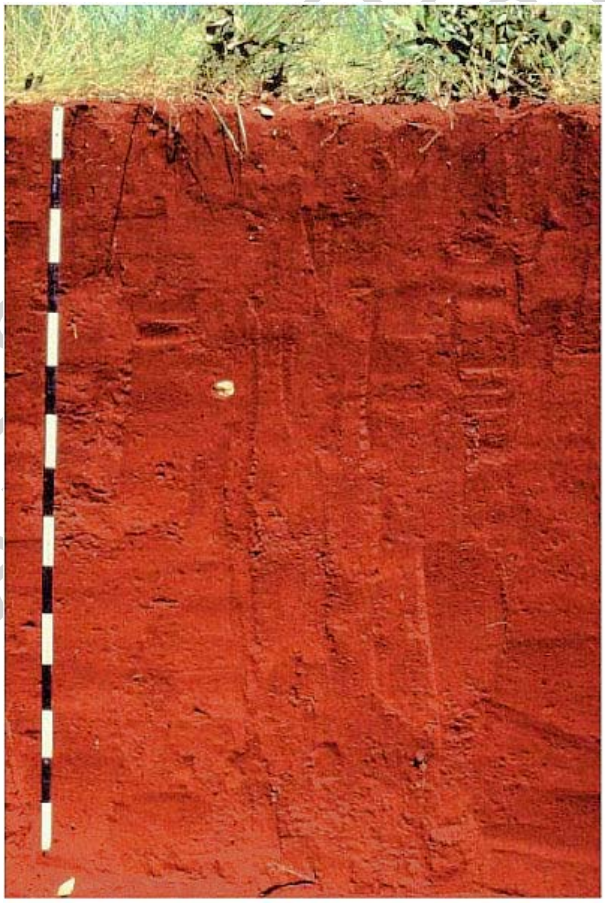

Figure 1. Feralsol is the red-colored tropical soil with strong resistant microstructure (CD-ROM “Major Soils of the World”).

A feature, complicating understanding and reflection of the soil diversity, is the continuity [continuality] of the soil in time and space. The totality of all soils and soil-like bodies forms the soil cover of the Earth. The continuality of the soils is expressed in that a base for the soil formation in the present-day landscapes is often created by ancient soils [or re-deposited material of ancient soils], which have been formed under the influence of factors, differing from those, which take place now. Effects of industrial human activity upon natural soil cover and formation of soils, which are in varying degree anthropogenically changed, can also enlarge the soil diversity, although, due to variety of conditions, types, and technologies of the land uses, reaction of soil cover to the anthropogenic impacts can be ambiguous. Negative human impacts upon the soil are widely known. But, in Figs. 2 and 3 one can see an opposite situation when long cultivation (for about 500 years) and regular permanent fertilization result in substantial positive transformation of surface soil horizons. A new thick fertile horizon, enriched with organic substance, is formed. And, as a result, under the influence of agricultural human activity the poor *Podzol* is transformed into a fertile soil, which is traditionally called in Northern Europe as *Plaggen* (according to international classification it is *Plaggic Anthrosol*).

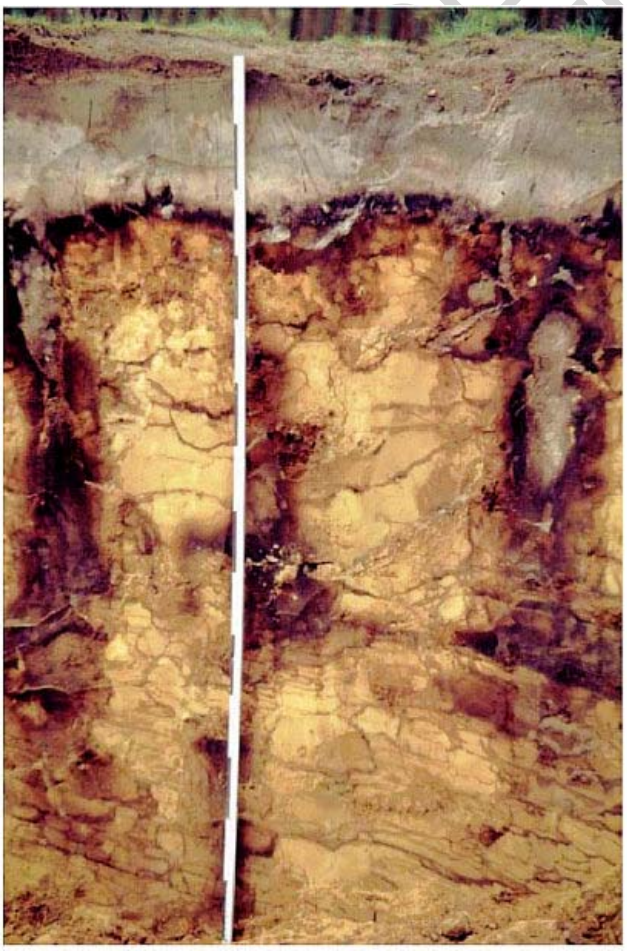

Figure 2. *Podzol* is a poor sandy-loam soil with a horizon of accumulation of mobile forms of humus, iron, and aluminum in the middle part of its profile (CD-ROM “Major Soils of the World”).

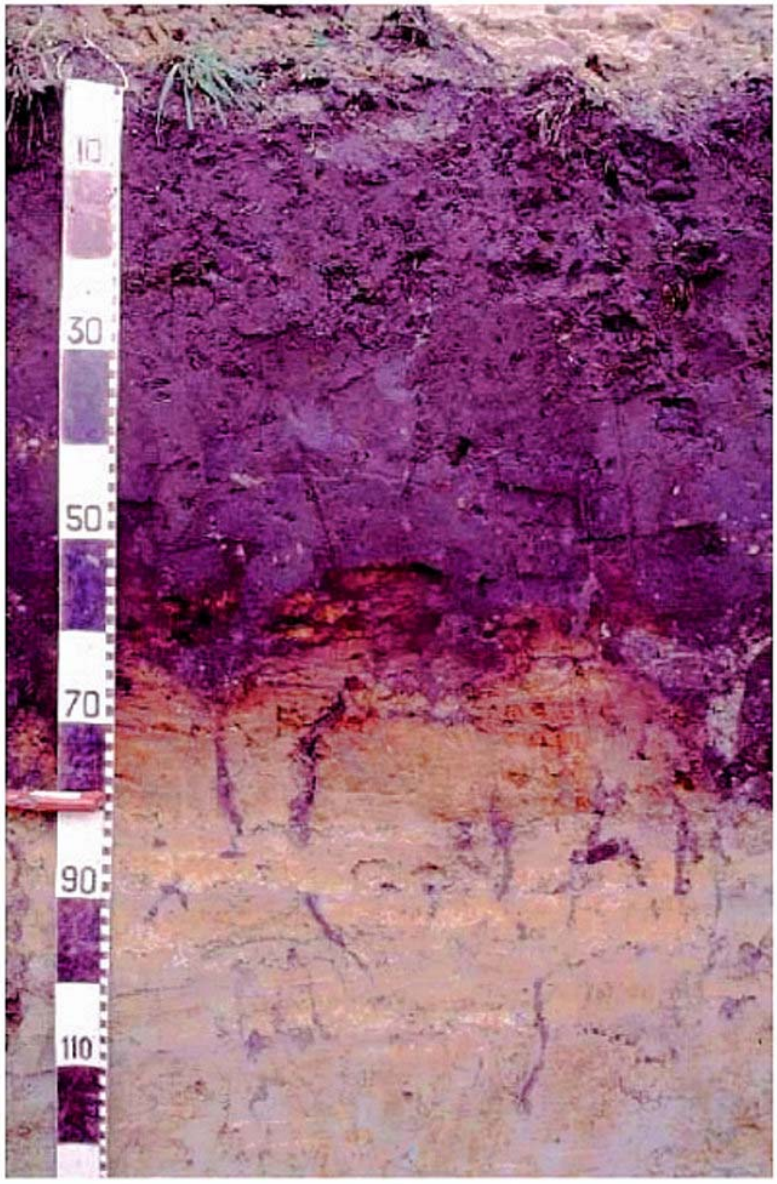

Figure 3. *Plaggic Anthrosol* is an anthropogenic soil with thick fertile surface horizon, having been formed in a course of 500-year cultivation. It is formed from the *Podzol* (CD-ROM "Major Soils of the World").

2. Classifications of Soils

Soil classifications are aimed at reflection of the soil diversity. Classification schemes, in which one tries to show the whole variety the world's soils, are called global. There are also an individual author's or national [state] classifications. Despite the above shown features of soil as a natural object, majority of soil classification schemes identify soil as a distinct object.

The base taxonomical unit of the soil classifications, created by colleagues and followers of V.V. Dokuchaev, is the Type of soil. Generally, the identity of a soil is based on a long-standing central image [archetype] of a soil profile, having a certain set

of properties and resulting from a certain set of processes of the soil formation determined by conditions, under which the soil is formed. Grouping above the Type level of / grouping at the highest levels of systematization and understanding of a great variety of soils, fine separation of types [into genus, kind, variety, etc.] is used for isolation of the whole diversity of transitional forms of soil bodies. The base taxonomical units are differently called in different soil classifications, but they are always correspond with series of archetypes.

Origin of names, used in the soil classifications, can be different. These are folk (people's), conventionalized names, which are sometimes re-invented using Latin and Greek roots; or created newly ["Soil Taxonomy", USA]. It is important for them to be monosemantic/ to reflect the strict sense(meaning) and bear the scientific sense and definition as terms. It is necessary to distinguish names and characteristics of soils [krasnozem and red soils, chernozems and soils of black colors; loam – in a name and as a granulometric characteristic].

There are hundreds of principal types and many thousands of kinds and varieties of soils, differing by structure, physical and chemical properties, hydro-thermal regime, composition and vital functions of the soil biota (living beings, inhabiting the soil, including microorganisms). Spreading of different types and kinds of soils over the Earth's surface and spatial structure of soil cover have rather regular zonal-geographical character, and they are conditioned by combined interaction of bioclimatic and lithological-geomorphological factors of soil formation. Regularities of geographical distribution of soils and structure of the soil cover are studied by special scientific discipline that is geography of soils.

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Biographical Sketch

Tatiana V. Prokofieva, PhD, was born in February of 1940 in Moscow (Soviet Union). In 1993, she had been graduated from the Lomonosov Moscow State University as a pedologist-agrochemist. A citizen of Russia, she is now one of known Russian scientists in the field of soil sciences. She deals with such problems as soils of urban territories, their genesis and geography, ecological evaluation and monitoring of soils and soil cover, classification of soils. Her PhD (1998) thesis was devoted to study of urban soils, sealed by pavements (by the example of the Moscow city). Since 1993, she works in the Lomonosov Moscow State University. She is the author of over 90 published works including papers, maps, and textbooks. She is a participant of international congresses and workshops.