

**GEOLOGY OF SRI LANKA:
MINERAL RESOURCES AND SOILS
ГЕОЛОГИЯ ШРИ ЛАНКИ:
МИНЕРАЛЬНЫЕ РЕСУРСЫ И ГРУНТЫ**

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Abstract. The article is an overview of geology, minerals and soils of Sri Lanka given on the base of the researches provided by other scientists.

Аннотация. В данной статье приведена обзорная информация о геологии, минералах и грунтах Шри-Ланки на основе исследований, проведенных ранее другими учеными.

Introduction

Sri Lanka is a tropical Island in the Indian Ocean consisting of a land area of 65,525 km². Sri Lanka lies on the Indian Plate, a major tectonic plate that was formerly part of the Indo-Australian Plate. The island consists mostly of flat to rolling coastal plains, with mountains rising only in the south-central part.

Geology

Geologically, the island of Sri Lanka is considered a southerly extension of peninsular India with which it shares a continental shelf and some of its basic lithologic and geomorphic characteristics. Sri Lanka is known as a part of East Gondwana, together with fragments of Antarctica, Australia, India, Madagascar, Mozambique and Tanzania. Sri Lanka acted as a bridge through which Antarctica and East Africa can be correlated. Thus, Sri Lanka reveals remarkable geological and geotectonic similarities to those of neighboring Gondwana fragments. The Proterozoic basement of

Sri Lanka exposes substantial parts of the lower continental crust [2].

In Sri Lanka 90% of the area is covered by Precambrian (over 600 million-year-old) metamorphic rocks. The other 10% which is in the Northern part of Sri Lanka consists of Miocene age (0-25 million years) limestone. Few Jurassic age out crops are also available in this area. Most of these rocks are covered by recently formed clay laterite, red earth and soil deposits. The Precambrian metamorphic rocks are further classified into few more groups as given below in Figure 1, considering their age of formation, mineral combination, metamorphosed conditions etc. [3]:

- Highland/South Western Complex,
- Kadugannawa Complex,
- Vijayan Complex,
- Wannni Complex.

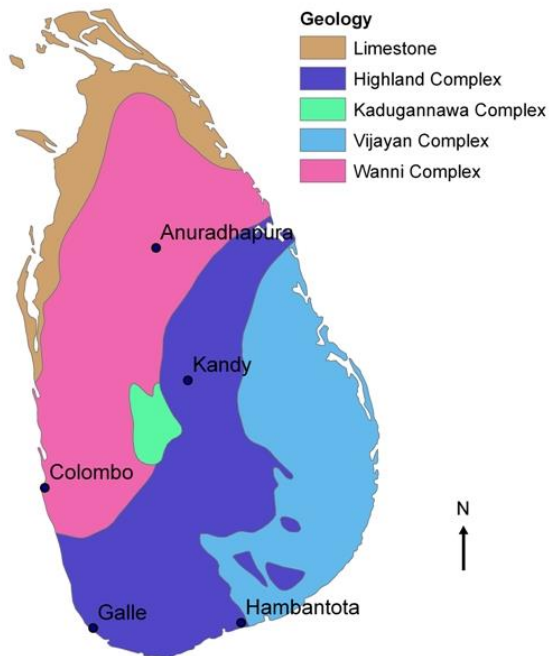


Figure 1. – Geological formations of Sri Lanka [1-3]

Four different units were distinguished based on isotopic, geochemical and petrological constraints, the Vijayan Complex in the east, the Highland Complex in the central, Wannu Complex in the west and the Kadugannawa Complex in between Highland Complex and Wannu Complex.

The Vijayan Complex consists mainly of amphibolite-facies granitoid rocks, metadiorites, metagabbros and migmatites while the Highland Complex is composed of intercalated meta-sedimentary and meta-igneous rocks of pelitic, mafic such as quartzo-feldspathic granulites, charnockites, marble and quartzite. Most of the Highland Complex rocks have attained granulite-facies conditions whereas some contain ultra-high temperature assemblages. Rocks in the Wannu Complex are granitoid gneisses, granitic migmatites, scattered metasediments and charnockites, which are metamorphosed under upper amphibolite to granulite facies conditions. The dominant rocks of the Kadugannawa Complex are hornblende and biotite-hornblende gneisses with interlayered granitoid gneisses in the core, pink feldspar granitic gneisses at the inner rim and metasediments at the outer rim of the arenas. Rocks of the Kadugannawa Complex are metamorphosed under upper amphibolite to granulite facies conditions. Post-peak metamorphic magmatic and hydrothermal activities are responsible for the formation of pegmatite, dolerite, carbonatite and granite bodies found in Sri Lanka. Hard and compact crystalline rock formations are distributed in the area of about nine-tenths of the island [2].

Mineral resources

The minerals being exploited in Sri Lanka are [3]:

- gemstones,
- graphit,
- mineral sand,
- apatite,
- dolomite, calcite and magnesite,
- limestone,
- vein quartz,
- feldspar,
- mica,
- silica sand,
- iron ore,
- clay,
- rock (stone),

- wollastonite,
- serpentine,
- peat,
- rare earth elements (monazite, thorianite).

Soils

Variations of soil within Sri Lanka reflect the effects of climate, lithology, and terrain on the soil-forming processes. The climatic influences are reflected in the dominance of red-yellow podzolic soils (leached lateritic soils) in the Wet Zone (see Figure 2) and of reddish brown earths (nonlateritic loamy soils) in the Dry Zone. In parts of the Central Highlands there are reddish brown latosolic soils (partially laterized soils) or immature brown loams (clayey loams). Among the other important soil types are the alluvials that occur along the lower courses of rivers and the regosols (sandy soils) of the coastal tracts [5].

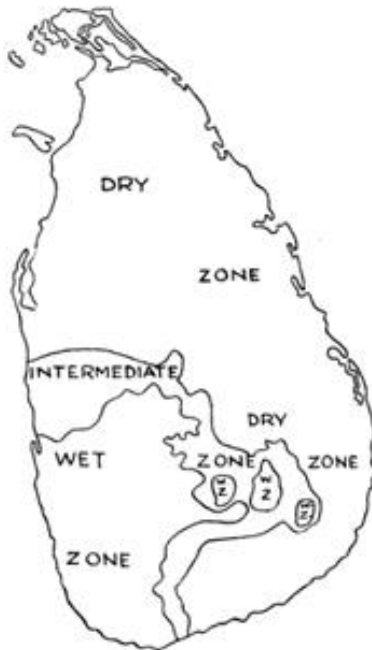


Figure 2. – General rainfall zones of Sri Lanka [5]

According to study of 1961 [5], Great Soil Groups of Sri Lanka are:

- reddish brown earths,
- noncalic brown soils,
- reddish brown lateritic soils,
- red-yellow podzolic soils,
- red-yellow latosols,
- immature brown loams,
- rendzina soils,
- grumusols,
- solodized solonetz,
- low-humic gley soils,
- meadow podzolic soils,
- bog and half-bog soils,
- alluvial soils,
- regosols.

The soil map and the Handbook of the Soils of Sri Lanka published in 1972 also consist of Great Soil Groups according to the local classification system [4].

One of the recent and important study of soils was provided by R. Mapa. The study started in 1995 and continued to year 2005. For more detailed classification the three rainfall zones, Wet, Intermediate and Dry zones, receiving a mean annual rainfall of higher than 2500 mm, from 1750 to 2500 mm and less than 1750 mm respectively were considered separately. A total of 28 bench mark pedons in the Wet Zone, 40 and 54 pedons in the Intermediate and Dry zone were characterized. These benchmark sites were geo-referenced using a global positioning system for easy interaction with other databases. The field characterization consists of topography, drainage, parent material, present land use, agro-ecological regions, etc. The soil profile was described according to FAO system and major soil horizons were identified. Soil physical properties including soil texture, bulk density, saturated hydraulic conductivity, wet and dry aggregate stability, and water retention were characterized using standard methods. The chemical properties characterized were soil pH, cation exchange capacity, base saturation, exchangeable bases including Ca, Mg, K and Na, organic carbon content electrical conductivity, total N and available P [4].

Conclusion

In conclusion it can be noticed that rocks of Sri Lanka are classified into four main groups, and variety of minerals and soils within Sri Lanka reflects the effects of climate, lithology, and terrain on the soil-forming processes.

References

1. Geological Map of Sri-Lanka [Electronic resource] : Joint Research Centre / European Soil Data Centre (ESDAC). – Mode of access: <https://esdac.jrc.ec.europa.eu/content/geological-map-sri-lanka>. – Data of access: 10.05.2020.
2. Guideline on Site Investigation for Rock Mass Classification System in Sri Lanka [Electronic resource] : Technical Assistance for Improvement of Capacity for Planning of Road Tunnels. – Sri Lanka : Road Development Authority (RDA) ; Japan : Japan International Cooperation Agency (JICA), 2018. – Mode of access: <https://openjicareport.jica.go.jp/pdf/12303541.pdf>. – Data of access: 10.05.2020.
3. Jayatileke, S. Geology and Mineral Resources of Sri Lanka [Electronic resource]. – Mode of access: <https://www.slideshare.net/indirankaralasingham/geology-mineral-resources-of-srilanka>. – Data of access: 10.05.2020.
4. Mapa, R. Classification and Mapping of Soils of Sri Lanka for Sustainable Land Management [Electronic resource]. – Mode of access: https://www.researchgate.net/publication/303309091_Classification_and_Mapping_of_Soils_of_Sri_Lanka_for_Sustainable_Land_Management. – Data of access: 10.05.2020.
5. Moormakn, F. R. Soils of Ceylon / F. R. Moormakn, C. R. Panabokkt [Electronic resource]. – Food and Agricultural Organisation of the United Nations ; Land Use Division Department of Agriculture Ceylon, 1961. – Mode of access: https://library.wur.nl/isric/fulltext/isricu_i00003194_001.pdf. – Data of access: 10.05.2020.