

KARST AND PSEUDOKARST LANDSCAPE OF GEORGIA (CAUCASUS).

A SHORT REVIEW

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ABSTRACT

Georgia is a classical karst country, where a variety of surface and underground karst forms are represented. The main aim of this work is to present karst and pseudokarst features in Georgia, which occupy 17.9% or 12,454 km² of the entire territory of Georgia. All layers of the Upper Jurassic, as well as the Cretaceous and Lower Paleogene systems are being karstified in Georgia. About 10.2% (7120 km²) of the country is occupied by karst (carbonate rocks). Limestones are represented by Upper Jurassic, Cretaceous and Lower Paleogene ages, while the crushed rocks (conglomerates, sandstones, breccias) with limestone cement represent the clastokarst distribution area of Neogene and Quaternary ages. Significant areas (About 7.7% or 5334 km² of the country) are also occupied by pseudo-karst relief developed in Mio-Pliocene clays and clay-rocks and Upper Eocene gypsum suite. Natural cavities are also found in effusive rocks, which cover large areas in southern Georgia. However, such pseudokarstic areas do not contain cave systems of significant size, but only contain some surface pseudokarst morphologies.

Keywords: Karst, Pseudokarst, Limestones, Caves, Georgia

INTRODUCTION

Georgia is a mountainous country located in the Caucasus region, which is home to multiple, widespread limestone massifs with well-developed karst areas and their associated landscape features found throughout the country [1] [2].

The dominant factors influencing the development of karst landforms in Georgia are as follows: lithological and structural conditions of the rocks, climatic factors, and topography, all of which are basic foundations important for karst development [3] [4] [5].

Among other factors the wide distribution of highly fissured thick carbonate rocks, abundant atmospheric precipitations, their erosive and corrosive abilities, deep erosive partition of the terrain and intense upward tectonic movement create favorable conditions for karst processes and intensive development of caves.

Karst in the Greater Caucasus Range is characterized by numerous rivers that cross the

massifs dividing them into tens of isolated areas separated by erosive gorges [6] [7]. Fragmentation into larger and smaller size karst massifs is a characteristic of the karst landscape of Georgia [8].

Due to geological, geomorphological, and speleological characteristics of the limestone massifs in Georgia, there are developments in classical karst processes and landforms, which contain very impressive karst features, such as dolines, caves, calcite depositions and others [9] [10] [11].

MATERIALS AND METHODS

Intensive research of the karst landscape in Georgia dates back to 1958, when a Karstology-Speleology Laboratory was established at the Vakhushti Bagrationi Institute of Geography. Today, the Institute of Geography is the only research center in Georgia, which, in collaboration with foreign researchers, conducts intensive karst landscape researches in Georgia. It is important to note that based on the complex studies conducted in Georgia in recent years, on the basis of the Institute, a Karst Map of Georgia has been compiled, which distinguishes karst and pseudo-karst relief types and their subtypes.

The data used in our study were based on 1:200,000 scanned and geo-referenced (Projection: Universal Transverse Mercator, Geographic Coordinate System: WGS-1984), geological maps [12] [13], as well as 1:25,000 topographical maps and aerial images. From the geological maps, zones were extracted, where all types of karst and pseudokarst features are distributed, and all the zones were grouped and analysed. All steps were performed in ArcMap 10.

RESULTS

Karst and pseudokarst relief and created by them landforms occupy 17.9% or 12,454 km² of the entire territory of Georgia (Fig. 1). All layers of the Upper Jurassic, as well as the Cretaceous and Lower Paleogene systems are being karstified in Georgia [8]. About 10.2% (7120 km²) of the country is occupied by karst (carbonate rocks). Limestones are represented by Upper Jurassic, Cretaceous and Lower Paleogene ages, while the crushed rocks (conglomerates, sandstones, breccias) with limestone cement represent the clastokarst distribution area of Neogene and Quaternary ages.

Significant areas (About 7.7% or 5334 km² of the country) are also occupied by pseudo-karst relief developed in Mio-Pliocene clays and clay-rocks and Upper Eocene gypsum suite. Natural cavities are also found in effusive rocks, which cover large areas in southern Georgia [8].



Fig. 1. Distribution of karst and pseudokarst features in Georgia

Karst landscapes are particularly well developed in western Georgia. They form a continuous belt (2-35 km wide) stretching 325 km in length from the Psou River to the Ertso Lake vicinity [7] [8]. The vertical distribution of karst in Georgia starts from sea level and extends to the absolute elevation of 2757 m (the Speleologists Peak, Arabika Massif, western Georgia).

Karst features are primarily developed in carbonate rocks (limestones and dolostones, conglomerates and sandstones with carbonate cement). They are mainly of Cretaceous age, and subordinately of Upper Jurassic and Lower Paleogene ages; however, Upper Jurassic and Paleogene carbonate rocks are mostly thin layered and less karstified.

Conglomerates and sandstones with carbonate cement are mainly present in western Georgia in the Central Odishi and Duripshi Plateaus (Samegrelo and Apkhazeti regions), where caves of significant size develop. For example, Kalichona Cave (length is 830 m) is the longest horizontal cave in the Caucasus region developed in conglomerates [8].

The karst features are relatively less intensely developed in other regions of Georgia, because of the lack of carbonate rocks and less favorable climatic conditions [14] [15].

Here it is necessary to distinguish the carbonate flysch that is presented in the map. Karst processes are very weakly expressed in the area of carbonate flysch; among them there are almost no surface and underground karst forms of significant size, which is mainly conditioned by the fact that in the mentioned area the limestone rocks are often presented by considerably thin layer [7].

The pseudokarst features developed in clays, clays and sandstones with gypsum content, and volcanic rocks with potential pseudokarst features are distributed over considerable areas, both in eastern and western Georgia; however, such pseudokarstic areas do not contain cave systems of significant size, but only contain some surface pseudokarst morphologies.

Locally, very impressive karst features (surface and subsurface) have developed, such as sinkholes, dolines, springs, waterfalls, caves, speleothems, and many others (Fig. 2). Currently, the total number of traced and partially studied caves in Georgia is over 1500 [11].

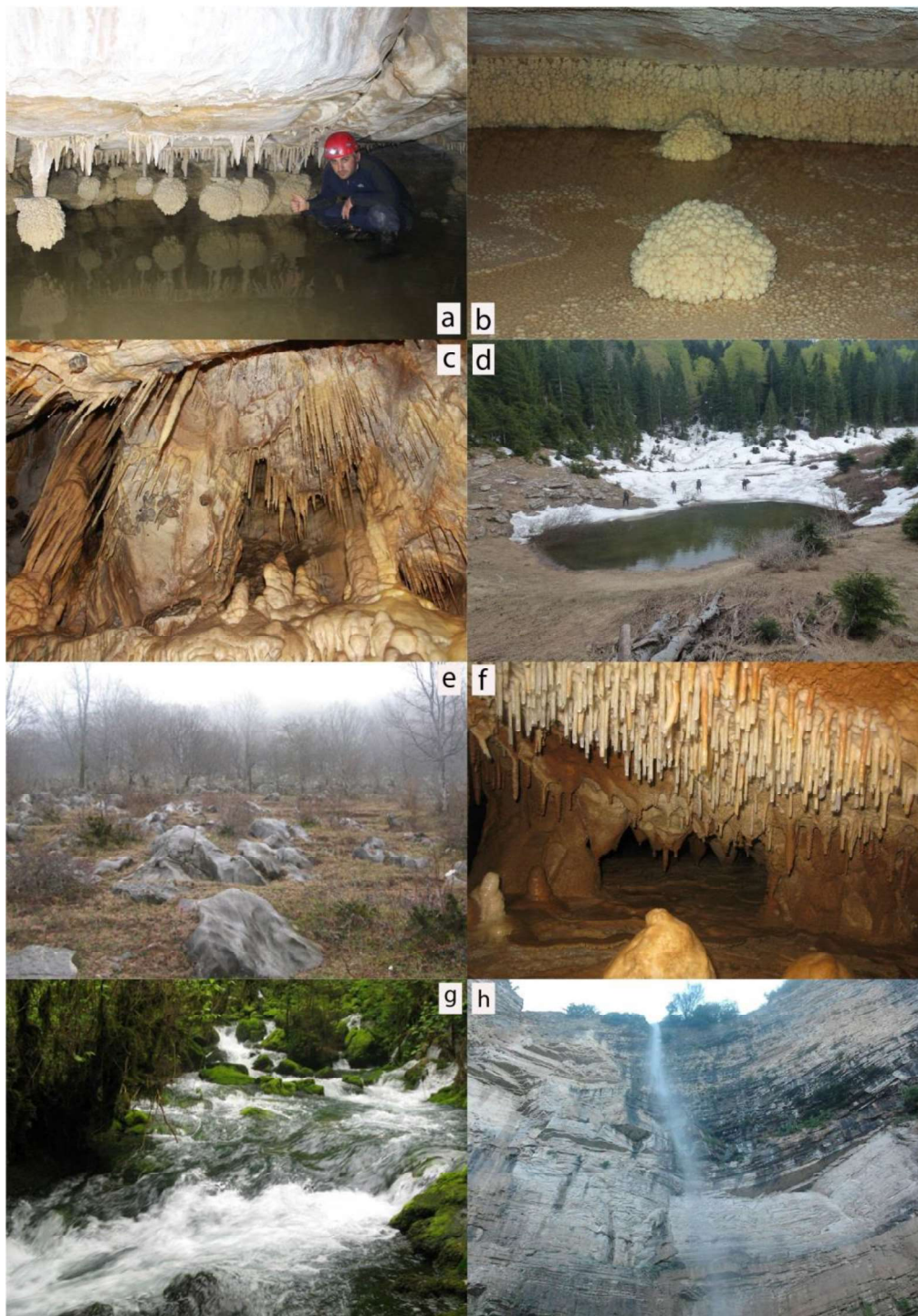


Fig. 2. **a)** Spherical examples of pool speleothems in Muradi cave, which could be formed from water level fluctuations over time (Racha Limestone Massif). **b)** Pool calcite speleothem deposited subaqueously at multiple places in Muradi cave (Racha Limestone Massif). **c)**

Beautiful examples of speleothems from Data Cave (Zemo Imereti Plateau). **d)** Classical karst doline full of water (Racha Limestone Massif). **e)** The outcropping karst (Godogani Plateau). **f)** Thin stalactites from Datvi cave (Sataplia-Tskaltubo Limestone Massif). **g)** Deidzakhi karst stream (Migaria Limestone massif). **h)** Kinchkha waterfall (Askhi Limestone Massif).

CONCLUSION

From studying the karst in Georgia, this research contains significant information, including the following findings: (1) we identified two types of karst features: karst (developed in carbonate rocks) and pseudokarst; (2) we identified their distribution areas which are important and essential in studying the karstology and speleology of Georgia; (3) We Also classified following subtypes: limestones and dolostones, conglomerates and sandstones, and flysch in carbonate rocks; clays, clays and sandstones with gypsum content, and volcanic rocks as pseudokarst.

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