Protected Areas and Remarkable Features of Inorganic Nature

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Abstract

According to landscape diversity, Georgia is in the 12th place in the world and in one of the 1st places in Europe. 14 Strict Nature Reserves, 11 National Parks, 19 Managed Reserves, 42 Natural Monuments, and two Protected Landscapes are presented in this chapter. in addition, there are many other interesting nature sightseeing that can be granted the status of natural monuments in the future, such as natural freezers, volcanic forms of relief, natural bridges, etc.

Georgia's diverse natural complexes (landscapes) and their individual components (vegetation cover, animal world, mineral resources, mineral waters, etc.) have been given wide possibility to use them since long ago that is approved by legislative acts.

The protection of nature has a long history in Georgia. Still in the King Tamar's Deed of 1189 AD, "forest guards" are mentioned, and even in the earlier Deed (1078)—a "Head of forest guards". The issues of water, forest, and pasture protection were envisaged in the "Book of Laws" of the King Vakhtang VI (1675–1737). In the mountainous regions, there were so-called "icon forests" (Georgian Soviet Encyclopedia 1981) under the strict protection.

The environment protection and rational use of natural resources of the country were substantially improved by the law adopted in 1996 by the Parliament of Georgia on the "System of Protected Areas", one of the main objectives of which is to adapt Georgia to the international categories (Strict Nature Reserve, National Park, Managed Reserve, Biosphere Reserve, Wetland Reserve, etc.) of protected areas elaborated by IUCN (International Union for Conservation of Nature).

The status of the first protected area in Georgia was granted to Lagodekhi Nature Reserve in 1912. The State Policy on establishing, functioning, and management of Protected Areas in Georgia is implemented by the Ministry of Environment Protection and Agriculture of Georgia and included in its Legal Entity of Public Law—Agency of Protected Areas. Currently, the total area of Protected Areas of Georgia is 595.963 ha, which is 8.55% of the country's territory. Approximately 75% of Protected Areas are covered by forests. There are 14 Strict Nature Reserves, 11 National Parks, 19 Managed Reserves, 42 Natural Monuments, and two Protected Landscapes (http://apa.gov.ge/ge/protected-areas/reserve); in addition, there are other types of areas in Georgia, where the certain regime of protection is being implemented, these

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are recreational forests (395.90 ha) including resort forests (119.40 ha) and green zones (276.50 ha) (Kajaia 1999).

The share of Georgia in total land area is only about 0.002%. Because of its small area, it is distinguished neither by the areas of forest, farm lands (38%), and the protected areas, nor the total number of flora and fauna species, but on the other hand, the country is specific, and in some cases unique in many ways. The main reason for this distinction and uniqueness is its geographical location and diverse natural conditions.

Georgia is a very interesting country in terms of biological and landscape diversities. As part of the Caucasus, it is included: (1) in the world's biologically richest and endangered 25 "hotspots" (Cl, CEPF), (2) in the world's sensitive and vulnerable 200 ecoregions (WWF), which is characterized by high biodiversity; (3) in the endemic bird's habitat (Bird Life International), (4) in one of the centers of agrobiodiversity of the world, and (5) in the "hotspot" of the large herbivorous animals (WWF); this list is even more extensive since in Georgia, first of all, the diversity of species and ecosystems and the rich endemic and relic, medicinal and decorative vegetation species are maintained and almost 40% of the area is covered by forests; and secondly, the environment of the country has not experienced such great anthropogenic changes as it was in many parts of the world. Therefore, in ecological terms, it looks like a relatively "clean area". In addition, Georgia is one of the most distinguished countries in the world with landscape diversity and it is ahead of many other countries rich in biodiversity (Beruchashvili 2000).

According to landscape diversity, Georgia is in the 12th place in the world and in one of the 1st places in Europe. Georgia is even more distinguished by its landscape diversity, and it is in the first place in the world. By calculation of scientists, there are two types of landscapes per each 90 thousand km^2 on average, while in Georgia there are 22 types in 69.7 thousand km^2. That is why Georgia was fairly named "the landscape laboratory of the world (Beruchashvili 2000). By landscape diversity, Georgia exceeds even the major countries such as Germany, Italy, France, Spain, Greece, Ukraine, Peru, Columbia, Venezuela, and others.

56 species of flora of Georgia are included in the Red List, status of 36 species is vulnerable, 18 species are endangered and two species are critically endangered, among the 135 species of fauna included in the Red List of Georgia, 87 species are vulnerable, 32 species are endangered, 11 species are critically endangered and five species are regionally extinct.

(Ordinance of the Government of Georgia on approval of the "Red List" 2014, https://matsne.gov.ge/ka/document/view/2256983).

Forests of Georgia have a specific nature, which is expressed in their special purpose. Almost all forests—98.3% of Georgia belong to the first group of forests located on the slopes of the mountains and have soil protection, water protection, resort, sanitary-hygienic, aesthetic, and other social-protective functions. The remaining 0.7% of the forest belongs to the second group and is mainly located in the Kolkheti Lowland.

Georgia is actively involved in the international projects on global ecological safety of environment protection, maintenance of ecological balance, ecosystem protection, and providing sustainable development principles. The country is joined to the world's important international (UN, Ramsar, Kyoto, Basel, Stockholm, etc.) conventions on environmental protection.

Currently, five types of protected areas are presented in Georgia: Strict Nature Reserve, National Park, Natural Monument, Managed Reserves, and Protected Landscape.

In Georgia, a special phenomenon of nature is the inorganic nature monuments of the country, which are scattered in different parts of the country in big amount. Among them the three groups are distinguished: geomorphological, geological, and hydrological. They include unique karst caves, replaced glacial and mudflow boulders, natural bridges, canyons, waterfalls, vaucluse sources, travertines, and fossil elements of flora and fauna.

There are 14 strict nature reserves (Babaneuri, Batsara, Bichvinta-Miusera, Borjomi, Vashlovani, Tusheti, Kintrishi, Lagodekhi, Liakhvi,

Mariamjvari, Sataplia, Ritsa, Pskhu-Gumista, and Kobuleti) in Georgia with total area of 139.048 thousand ha.

Babaneuri Strict Nature Reserve (area 862.1 ha) is located at the foot of the main range of the Caucasus, in Akhmeta municipality at the villages of Babaneuri and Argokhi, on the bank of the Alazani River, at the height of 439–985 m above sea level. The reserve was established in 1950 to protect the rare massive of the Tertiary age relic—the hornbeam left Zelkova (Zelkova carpinifolia).

Batsara Strict Nature Reserve (area 2.986 ha) is located in the gorge of the Batsara River (the right tributary of the Alazani River) in Akhmeta municipality. It was established in 1935. The untouched groves of the relic species —yew (Taxus baccata) are preserved in the strict nature reserve, which has a great scientific value.

Bichvinta-Miusera Strict Nature Reserve (area 165 ha), was created in 1966 to protect the Bichvinta relic and Colchis broad-leaved forests. The strict nature reserve is located on the Black Sea coast of Abkhazia and consists of three sections– Bichvinta, Miusera (218 ha), and Lidzava (1296 ha). The main beauty of the Bichvinta-Miusera Strict Nature Reserve is the Bichvinta Pine (Pinus pityusa), from the root of which the name Bichvinta is derived.

Borjomi Strict Nature Reserve (area 17.948 ha) is located on the southern slopes of Achara-Imereti range, in Borjomi municipality. It was established in 1935 to protect, restore and reproduce the red deer, as well as to preserve the forest massifs of endemic species. Many relic and endemic plants grow in the territory of the strict nature reserve, many of which are rare and endangered. These are Georgian hazel, European hop-hornbeam, yew, chestnut, Colchis bladdernut, and common bladdernut, Caucasian oak, sea buckthorn, wild grape vine.

Vashlovani Strict Nature Reserve (area 10 142 ha) is located in the Iori Upland, in Dedoplistskaro Municipality. It was established in 1935 and since 2003 the unified complex of strict nature reserves, national parks, and natural monuments is included in the Vashlovani Protected Area. The strict nature reserve was created for the protection of arid light forests. Here grows the rarest pistachio trees (Pistacia mutica), hackberries, weeping pear, a variety of junipers, endemic Georgian Iris (Iris iberica), and tulips (Tulipa eichleri). Among mammals, there can be found brown bears, gray wolves, red foxes, Eurasian lynx, and wild boar. There are many reptiles in the strict nature reserve: common tortoise, Schneider's skink, and Caucasian agama; from the snakes: the javelin sand boa, the four-lined snake, the grass snake, and the Lebetine viper. In the reserve there are many birds, for some of them Vashlovani and its surrounding is a homeland, and for some of them it is a wintering area and place of temporary shelter. Here are found buzzard, eastern imperial eagle, etc.

Tusheti Strict Nature Reserve (area 12,627.2 ha) is located in Akhmeta municipality; established in 1961. The strict nature reserve was created to protect and preserve the species of biodiversity, rare and endangered animals, and endemic and relic plant species presented there.

The forests of the strict nature reserve are distinguished by species diversity, high endemism, and very specific bio-ecological, relic species. Here are the subalpine birches and rhododendrone complexes. The strict nature reserve is important as the habitat of rare animal species of Tertiary period.

Kintrishi Strict Nature Reserve (area 10,703 ha) was established in 1959; it is located in the Kintrishi River gorge, in Kobuleti municipality, Achara. In Kintrishi Strict Nature Reserve, the climate is very humid; there are many rivers and gullies, waterfalls, and the Tbikeli Lake. The strict nature reserve was founded to protect the Colchis flora and fauna of the Tertiary period. There are many endemic and relic species preserved in the strict nature reserve.

Lagodekhi Strict Nature Reserve (area 19,749 ha) is located on the southern slopes of the main range of the Caucasus in the territory of Kakheti. It was established in 1912. The forest covers the area of 12,346 ha (72%) and the remaining 5322 ha are covered by alpine pastures. It extends to the height of 450–3500 m above sea level. The forest belt (up to 450–2300 m) with Georgian oak trees and oriental

beech trees and the alpine belt (2300–3500 m above sea level) with meadows, meadow grasses, and rhododendrons are sharply distinguished. Between these belts are the subalpine light forest (mountain oak and sycamore maple) and crooked (birch) forest belts (1700–2300 m above sea level). There is a subnival belt (3000 m above sea level) with very light herbs above the alpine belt. Lagodekhi is famous for its best-preserved forests, most of which are almost untouched including the less-modified (untouched) forests of beech and hornbeam trees.

Due to the moderately humid subtropical climate, the elements of the Colchis and Talishi vegetation have been maintained here, such as: wingnuts, common walnuts, chestnuts, etc. There are about 1500 species of floral plants in the strict nature reserve; it is rich in endemic species, where 121 species of flora are endemic to Caucasus and nine species—to Georgia endemic, from which seven are found only in Lagodekhi. There are 42 species of mammals, 120 species of birds, four species of amphibia, and eight species of reptiles recorded in the strict nature reserve. The museum of flora and fauna is located in the strict nature reserve, as well as the high mountain meteorological station. There are many waterfalls and lakes in the territory of the strict nature reserve; among lakes, the "Black Rock Lakes" are notable (about 2850 m above sea level).

The World Wide Fund for Nature (WWF) has been identified as one of the most important global ecoregions (ecoregion of Caucasian mixed forests), the Important Bird Area (GE 024), and a hot point of biodiversity according to the conservation. The Lagodekhi Protected Areas are also recognized as a potential candidate for "Emerald Network", and also it is qualified for "Natura 2000" according to the obligations taken by Georgia under the Association Agreement between Georgia and the European Union (Fig. 17.1).

Liakhvi Strict Nature Reserve (area 6388 ha) was established in 1977 for the protection of subalpine forests. The strict nature reserve is located in the north-eastern part of Tskhinvali municipality, in the upper stream of the Patara Liakhvi River. In the Liakhvi Strict Nature Reserve, the deer inhabits that is found only here within the area of the Central Caucasus.

Mariamjvari Strict Nature Reserve (area 1040 ha) is located in the Sagarejo municipality, on the southern slopes of the Gombori Range. It was established in 1935 for preservation of rare massif of the relic Caucasian pine (Pinus sosnowskyi Nakai). There are four forms of the Caucasian pine (different forms of crowns—polymorphisms): pyramidal, compact, oval, and umbrella.

Sataplia Strict Nature Reserve (area 330 ha) is located in the Tskaltubo municipality, in the Sataplia mountain, at a height of 500 m above sea level; it was established in 1935; its area is 330 ha. The strict nature reserve is of complex character and includes geological, paleontological, speleological, zoological, and botanical monuments. Its relief is a mountainous. 95% of the area is covered by relict Colchis forest. The strict nature reserve area is rich in karst caves. There are found about 200 footprints of predator and herbivore dinosaurs on the marl limestones. The biospeleological museum is located I the strict nature reserve.

Ritsa Strict Nature Reserve (area 13.893 ha) is located in the Gudauta municipality (60 km away from Gagra), in Apkhazeti. The strict nature reserve is represented in the southern subrange of the main range of the Caucasus. The Ritsa Strict Nature Reserve is located at a height of 928 m above sea level and covers the area around the Ritsa Lake. The strict nature reserve was created in 1957 to protect the Ritsa Lake and the relic forests around it. In the forest massifs the oaks, hornbeams, lime trees, box trees, and others prevail. The groves of Caucasian fir and pine trees and oriental beech trees are spread at a height of 600–1800 m, and Caucasian fir and Oriental spruce forests at the height of 1800–2200 m above sea level.

Phskhu-Gumista Strict Nature Reserve (area 27.334 ha) is located mainly on the southern slope of the main range of the Caucasus, in Sokhumi region, in the gorge of the eastern Gumista River. The Gumista Strict Nature Reserve was established in 1978 to protect the

Fig. 17.1 Lagodekhi strict nature reserve (Photo by R. Tolordava)

biodiversity of the untouched deciduous and coniferous forests in Apkhazeti. The Pskhu Nature Reserve is situated in the hollow of the Pskhu River, which is bordered by the Bzipi range and the main range of the Caucasus.

Kobuleti Strict Nature Reserve is located in the Achara Autonomous Republic and includes the north-eastern part of the Kobuleti coastal plain; it was established in 1998 to save and preserve the unique wetland ecosystems of international importance, as a natural heritage of high value, especially as a waterfowl habitat, the status of which is recognized by the Ramsar Convention. These peat bogs are distinguished by the diversity of waterfowl birds and plants. There are important habitats for migrating, nesting, and wintering species of waterfowl birds.

The first national park in Soviet Georgia, named "**Saguramo National Park" (Tbilisi National Park** nowadays), was created in 1973. Tbilisi National Park (Area 21 030.81 ha) is located in the territory of Mtskheta-Mtianeti region, Tbilisi (partly), and Kvemo Kartli region. Tbilisi National Park is rich in representatives of fauna. The following mammals are widespread: red fox, wolf, roe deer, rabbit, forest marten and least weasel as well as the rare species such as Caucasian red deer, lynx, and brown bear. 46 endemic species of mammals in the park are common. Among the ornithofauna the following species are found: Eurasian magpie, common blackbird, and several kinds of woodpeckers. From the predatory birds, the Eurasian sparrowhawk is spread in the park. Representatives of the "Red List" are: imperial eagle, spotted eagle, and Levant sparrowhawk.

There are 12 species of reptiles in the park area. The most common among them is the European legless lizard; there is found grass snake, Caspian whipsnake, and smooth snake.

In 1995 the first national park was established, which was named "**Borjomi-Kharagauli National Park**" by the assistance of the World Wildlife Fund (WWF) and the German Government. This was the foundation of the first national park in the Caucasus region. Renewed in

2001. The Borjomi-Kharagauli National Park is located in the central part of the Caucasus ecoregion. Because of the distinctive biodiversity and vulnerability, the ecoregion is included in the list of 35 preferential ecoregions of the World Wildlife Fund and 34 hot spots of international conservation. Borjomi-Kharagauli National Park (area 60 576.4 ha) is located in the central part of Georgia, in the region of the Lesser Caucasus, located in the territories of Samtskhe-Javakheti, Imereti, and Shida Kartli regions. It is one of the largest national parks in Europe.

The main wealth of Borjomi-Kharagauli National Park is forest (75% of the territory). There are preserved the large areas of untouched mixed forests of the Caucasus; there are found the fragments of unique, relict Colchis forests. Almost a quarter of the park is covered by subalpine and alpine meadows, as well as the rhododendron shrubs (the relic Georgian snow rose shrubs), where there is also subalpine crooked Litvinov's birch (Betula litwinowii).

Forests and high mountains are rich in relic, endemic, rare and vulnerable species of not only flora but fauna as well. There are documented 64 species of mammals on the territory of Borjomi-Kharagauli National Park, 11 of which are endemic to Caucasian, and eight species are listed in Georgia's "Red List". There are can be found 217 species of migratory and nesting birds 13 species of which are included in the Georgian "Red List". 30 species of reptiles inhabit in humid forests of the protected area, three of which are endemic to the western Caucasus, and two species are included in the "Red List".

In the Borjomi-Kharagauli National Park herpetofauna includes almost all species of amphibians and four rock lizards that are common in Georgia. The diversity of amphibian species is not observed anywhere else in Georgia. The Borjomi-Kharagauli National Park is an important habitat for the diversity of amphibian species. In Borjomi-Kharagauli National Park about 17 species of reptiles and amphibians are common, including the endemic to Caucasus—the Caucasian salamander (Mertensiella caucasica), which is a rare and endangered species. It is included in the "Red List" of Georgia and IUC.

In the rivers of the Borjomi-Kharagauli Protected Areas are found brown trouts (Salmio fario trutta), common barbel (Barbus barbus), and common roach (Rutilus rutilus).

In 1998 **Kolkheti National Park** was founded, in 2003—Tusheti and Vashlovani National Parks, and in 2006—Mtirala National Park. Machakhela and Javakheti National Parks have been created in recent years and Algeti, Saguramo, and Kazbegi Strict Nature Reserves have been granted status of National Park. In the nearest future, Kazbegi and Algeti National Parks will be expanded.

Algeti National Park (area 6822 ha) is located in historical Kvemo Kartli, Tetritskaro municipality, 60 km away from Tbilisi. it was established in 1965, and renewed in 2007. It is situated in the Algeti River gorge and covers the southern slopes of the eastern part of the Trialeti Range at the height of 1100–1950 m above sea level. The highest point is Kldekari (2000 m). The national park is characterized by a humid climate. It was founded for the protection of the Oriental spruce and Caucasian fir's eastern border. Among the deciduous species beech, oak, hornbeam, ash, and birch trees are spread. Here are 1664 species of plants; three species are endemic to Georgia and Caucasus. The fauna of the National Park is also rich. Here inhabit the animals of the "Red List" of Georgia: brown bear, Caucasian grouse, eastern imperial eagle, and others.

In the vicinity of the Algeti National Park numerous archaeological sites have been discovered, most of the earliest of which are of the Eneolithic and early Bronze Ages. The Bronze Age cyclopean fortresses, the active churches and the ruins of the churches, the ruins of the Kldekari fortress of the ninth century, the fourth-century Manglisi Cathedral, the beautiful and inaccessible Birtvisi town- fortress of the eleventh century, and others are preserved.

The national park has quite a good potential for organizing the photo-video, birdwatching, ecological, botanical, and motor-adventure tours. In the protected areas are developed the forms of tourism such as hiking, horseback riding, and archeological tours.

Vashlovani National Park (area 24 610 ha) is located in Kakheti, Dedoplistskaro municipality; it was established in 2003. The climate is dry and moderately dry there. It was created to preserve the arid ecosystem in the natural condition and to protect and restore rare species of plants and animals spread throughout the territory.

The Vashlovani National Park (Fig. 17.2), along with the Vashlovani Strict Nature Reserve, covers the less-modified natural ecosystems with sharply distinguished four vegetation types: semiarid, arid light forest, steppe, and deciduous forest. In addition, there are intrazone types as well: rocks' xerophytes, floodplain, or riparian forests, Jerusalem thorn, and other vegetation of foothills. Savanna-type arid light forest is preserved, the main component of which is the Mt. Atlas mastic tree (Pistacia mutica) and juniper.

The only habitat of the Tertiary period relic—desert poplar (Populus euphratica) in Georgia is the Vashlovani National Park. Ornitho-fauna of Vashlovani National Park is very diverse—Rock partridge, woodpecker, Griffon vulture, Cinereous vulture, sparrowhawk, European nightjar, golden oriole, bee-eater, and mistle thrush.

After some time, he lost the status of the National Park but was it was reestablished in 2007 on the basis of the part of the former National Park and Saguramo Nature Reserve. It is spread over 600–100 m above sea level. Dendroflora of the Tbilisi National Park is interesting because of the distribution of the representatives of Tertiary period Colchis flora, such as: Colchic holly, Colchis ivy, and Pastukhov's ivy, eastern viburnum, ruscus, yew, the Caucasian rhododendron, cherry laurel and more. Pine trees and unique yew groves are artificially cultivated in the park. Forests are characterized by vertical zoning in the National Park of Tbilisi. From rare and endangered species in Tbilisi National Park are spread: boxwood (Buxus colchica), yew (Taxus baccata), a bare elm (Ulmus glabra), a small elm (Ulmus glabra), walnut (Juglans regia), Pontine oak (Quercus pontica) and others (Kikodze 2007).

Tusheti National Park (area 69.515 ha) is located in the Eastern Caucasus. It comprises the northern slopes of the main range of the Caucasus, including the Tusheti basin and the Speroza Range. The northern and eastern borders coincide with the Georgian state border with the Russian Federation. It was established in 2003. The lowest point of Tusheti National Park is located at 1600 m above sea level and the highest—at 4275 m.

The park includes the Tusheti Strict Nature Reserve, which comprises the gorges of the rivers: Pirikita Alazani, Gometsari Alazani, and Chanchakhovani. Alpine meadows, glaciers, river heads, separate important cenoses, rare and endangered animals, and endemic and relic species are preserved in Tusheti National Park, as well as the unique pine forest and the presented forest's forming species: birch, high mountain oak, rowan and goat willow.

Tusheti National Park is characterized by landscapes of high aesthetic values (Fig. 17.3), beautiful alpine meadows, and very well preserved pine forests; summits of the mounts of Tebulo (4492 m), Diklo (4785 m), and Sakisto (2456 m).

In the gorge of Pirikita Alazani, in the areas of the village of Dartlo, there are several places where powerful deposits of the limestone travertines are presented. There are many small lakes of different origins. The high mountain wetlands are found in Shenako, Omalo, Tursiekhi, and Khakhabo vicinities. Tusheti is rich in mineral waters in the villages of Omalo, Shenako, Parsma, Chontio, Chigho, Dochu, Khakhabo, and others.

Tusheti Protected Areas are characterized with astonishing landscape diversity. Here we encounter the ecological "mosaic" created by pine forests, subalpine shrubs and forests, subalpine and alpine meadows, and glaciers.

Kolkheti National Park (Fig. 17.4) (the total terrestrial area of Kolkheti National Park is 28 571 ha and sea water area—15 742 ha) is located in western Georgia. It was established in 1998. It includes the Black Sea eastern coastline and the Paliastomi Lake basin. The national park is created for the preservation and maintenance of the wetland ecosystems of international importance in Kolkheti. The sections of the national park are

Fig. 17.2 Vashlovani (Photo by V. Cherkezishvili)

Fig. 17.3 Tusheti (Photo by N. Bolashvili)

Fig. 17.4 Kolkheti National Park (Photo by R. Tolordava)

located in the territories of five municipalities—Zugdidi, Khobi, Senaki, Abasha, and Lanchkhuti and are the parts of Samegrelo and Guria–the two historic regions of Georgia.

Kolkheti wetlands primarily are important because to their relic origin. The lowland is a remnant of the Cenozoic period's tropical and subtropical landscapes that were stretched as a continuous strip across the entire Eurasian continent about 10 million years ago. The plants, characteristic only to the distant northern tundra and taiga swamp ecosystems, have been preserved in Kolkheti.

The areas of Kolkheti National Park are especially interesting from botanical point of view. There are preserved the complexes of phytocenoses quite diverse by florist composition and rich in relic and endemic species—different vegetation groups of sandy dunes located along wetlands, wetland forests, and coastline. 194 species of birds inhabit the Kolkheti National Park.

There are also a number of bird migration routes in the park: in the autumn—from north to south, in the spring—from the warm countries to their nesting places, and for some species, Kolkheti is a wintering (they do not need to fly more south). During the massive migration of birds, it is possible to observe many rare birds (Birdwatching).

In the Kolkheti wetland floodplains, forests, and shrubs the following large mammals are common: golden jackal (Canis aureus), wild boar (Sus scrofa), roe deer (Capreolus), and Eurasian otter (Lutra lutra). The European tree frogs and the pond frogs are notable among the Kolkheti inhabitant amphibians. From the reptiles, the smooth newt, northern banded newt, the water snake, the Aesculapian snake, and European pond turtles are spread. The ichthyofauna of the national park area is represented by 88 species of fish (23 passing species, 21 freshwater fish, and 44 the Black sea fish species). Among the cartilaginous fishes the Atlantic sturgeon is remarkable and among the osseous fishes—the Black sea salmon, herring, flathead gray mullet, pike, mackerel, and others.

6 species of mammals of the "Red List" of Georgia are spread in the Kolkheti National Park, and 16 mammals of the endemic species are inhabited there. Administration of Kolkheti National Park offers the tourists the boating tours

on the Paliastomi Lake and in the Pichori River gorge, as well as the sport fishing, birdwatching and eco-educational tours.

Machakhela National Park (area 7333.18 ha) is located in Achara Autonomous Republic, in the Machakhelastskali River gorge, in the territory of Keda and Khelvachauri municipalities at about 300–350 m above sea level. It was established in 2012 to preserve the unique biological and landscape biodiversity, the long-term protection of the Colchis mixed deciduous forests (with the domination of beech), ecological safety and provision of development of tourist and recreational activities in the safe natural environment.

About 95% of the park's area is covered by forests of chestnut, beech, horn, and alder. There is a rare diversity of endemic and relic species there; 13 out of timber species are included in the "Red List" of Georgia. The park is rich in animals too: brown bear, gray wolf, Eurasian lynx, etc.

There are cultural and historical monuments in the vicinity of the national park, such as: arched bridges of different periods, fortresses, winepresses, and wine cellars built from stone and lime. From the Mount Mtavarangelozi in the territory of the park, the most beautiful views of the city of Batumi, the Machakhela River valley, and the confluence of the Chorokhi River with the Black Sea are seen.

Mtirala National Park (area 15,698.8 ha) was established in 2006 and is located in Achara, between the Mount Mtirala, Black Sea, and Achara mountain system at the crosswater of the rivers of Chakvistskali and Korolistskali. The climate is very hot, with 4520 mm of precipitation all year round. The toponym "Mtirala" ("Crying") was given the mountain because of abundant precipitation.

In the area of the national park, the forest vegetation represented by chestnut, beech, and Colchis type mixed forests is common, as well as the evergreen common rhododendron shrubs characteristic to Kolkheti.

In the Colchis forest, the beech, lime, chestnut, alder, and hornbeam are found. The subforest is covered with common rhododendron, which consists of cherry laurel, a Colchic holly, a Colchic box, and several types of lianas.

In the territory of Mtirala National Park, rare and endemic species of Achara-Lazeti and the "Red List" of Georgia are spread.

Javakheti National Park (area 13.498 ha) is located in Samtskhe-Javakheti region; it was founded in 2011. It includes certain areas of Akhalkalaki and Ninotsminda municipalities. It is located in the Javakheti Plateau, where there are many lakes including the Paravani Lake—the largest lake in Georgia.

Javakheti is a forestless region. There are found artificially planted pine groves and small fragments of natural forest. The most important natural subalpine forest is located in the area of the Kartsakhi Lake. There are documented almost 40 species of mammals in Javakheti highland including 10 predators and two hoofed animals.

In Javakheti there are many nesting waterfowl birds (a significant part of which remains here in winter and moves from frozen lakes to rivers). Seasonally, especially in autumn, this area is filled with predatory water or swamp birds.

Pshav-Khevsureti National Park (area 75 842.7 ha) is located on the northern and southern slopes of the Caucasus Mountain Range on the territory of Dusheti municipality and includes the gorges of the rivers of Asa, Arghuni, Andagistskali, Khevsureti Aragvi and Pshavi Aragvi, as well as the populated areas—Anatori, Mutso, Kistani, Lebaiskari, Kalotana, Amgha, Chimgha, Andaki, Kino, Bindaurta, Archillo, Chechketi, Shatili, and Ardoti. It was founded in 2014.

The aim of the creation of the Pshav-Khevsureti National Park is to protect, restore, and preservation of biological diversity of Pshav-Khevsureti natural ecosystems, animal and plant worlds, and also to create favorable conditions for education and scientific research. In addition, the protection and restoration of historic-cultural monuments and the survival of unique ecosystems should be ensured. The traditions of folk art should be maintained and developed.

In the national park, the vegetation cover is represented by deciduous forest. In Piraketa Khevsureti can be found oak, aspen, beech, goat

willow, willow, alder, birch, lime, rowan, walnut, pear, apple, cherry plum, hazel, cherry, elm, juniper, and pine. Pirikita Khevsureti is poor in forest; the pine and birch are grown at a higher altitude and the yew—in the village of Katsalkhevi (Pshavi); the lime tree, rowan, goat willow, elm, maple, common ash, juniper, rhododendron, willow, and alder. In this area, there are many subalpine and alpine meadows.

Kazbegi National Park (area 8 685.3 ha) is located in the historic gorge on the northern slopes of the Caucasus Mountain Range. It was established in 1976 and renewed in 2007. Only 35% of the national park is covered by forests, the rest are covered by alpine meadows, moraines, permanent snow-covered peaks, and inaccessible rocks. The rocks and mountains of the national park represent a shelter for rare and unique species of animals and birds. Kazbegi National Park is high mountainous and its lowest point is located at 1400 m above sea level.

The vegetation cover of the Kazbegi National Park is represented by 1347 species, 26% of them are endemic plants. Alpine, subalpine, xerophyte, and many other ecological groups of vegetation are spread here, some of which are included in the "Red List" of Georgia. There are also relic and endemic species here.

The national park is rich in fauna. Most of the animals presented found here are represented by rare, endangered, and included in the "Red List" of Georgia species.

In addition, there are two types of globally important birds in the national park: great rosefinch (Carpodacus rubicilla) and Güldenstädt's redstart (Phoenicurus erythrogaster).

The category of Managed Reserve did not exist in Georgia until 1996. At that time, the state forest and hunting farms were created that were governed by the Main Administration of Protected Areas, Strict Nature Reserves, and Hunting Farms of Georgia. The first hunting farm was created in 1957 in the Gardabani region. The managed reserves were created in 1997 according to the Georgian Law on Animal World, on the basis of the state forest and hunting farms.

Currently, in the managed reserves, where previously forestry and hunting farms were operating, hunting farms have been established based on the special license. These managed reserves are—Gardabani, Iori, Chachuna, and Korughi Managed Reserves. Nowadays there are 19 managed reserves in Georgia (Asa, Ajameti, Bughdasheni, Gardabani, Tetrobi, Kartsakhi, Katsoburi, Ilto, Iori, Lagodekhi, Madatapa, Nedzvi, Sataplia, Sulda, Kobuleti, Korughi, Ktsia-Tabatskuri, Chachuna, Khanchali, etc.) and their total area is 71,530.45 ha (http://www.apa.gov.ge/ge/protected-areas/managedReserve).

Asa Managed Reserve (area 3943.38 ha) covers the left slope of the Asa River gorge and the origins of the gorges of its left tributaries (Aragvistskali, Akhielistskali, etc.). it was established in 2014. The territory of the Managed Reserve consists of virgin coniferous forest massifs, which is a permanent habitat of the species of "Red List" of Georgia—bear, wild goat, and chamois. This area is likely particularly important for leopards. Exactly in these areas was noted the last case of the killing of the leopard and the footprint of this animal was recorded during the last years.

Ajameti Managed Reserve (area 4990.57 ha) is located in the Imereti region, in the territory of Baghdati and Zestaponi municipalities; it was established in 1929, renewed in 2003, and is made up of two massifs: Ajameti oak forest (3824 ha, between the Kvirila and Khanistskali Rivers—the left tributaries of the Rioni River) and Vartsikhe massif (1166 ha, on the left side of Khanistskali). The goal of its establishment was to preserve the rare Colchis forest and the Tertiary relics—Imeretian oak, Zelkova, and Strandzha oak, as well as protection, reproduction, and scientific study of fauna. The famous oak forest is very old. The age of some trees is more than 250 years.

Bughdasheni Lake Managed Reserve (Area 119.3 ha) is located in the territory of Javakheti National Park. It includes a part of the Ninotsminda municipality territory. It was established in 2011. There are many varieties of birds of different species in the Managed Reserve. The lake freezes in winter.

Gardabani Managed Reserve (area 3 733.7 ha) is located at the border of Gardabani

and Marneuli municipalities near the border with Azerbaijan. The Managed Reserve was established in 1957 and renewed in 2007.

The Gardabani Managed Reserve was established to maintain forest groves in this area, improve their condition and protect the fauna inhabiting there. The main wealth of the Gardabani Managed Reserve is the floodplain forests, the main trees of which are: gray poplar, black poplar, quaking aspen, floodplain oak, elm and small wych elm. In the protected area of Gardabani there can be still found a red deer, which is included in the "Red List" of Georgia.

Tetrobi Managed Reservoir (area 3100 ha) is located in the Javakheti Upland, to the northern from Akhalkalaki, on the crossroad of the historical regions of Tori and Javakheti. The Managed Reserve was created in 1995 to protect forest massifs and local endemics in Javakheti Upland. The Managed Reserve is very interesting in florist terms, and scientists call it even the nest of endemics.

Kartsakhi Managed Reserve (area 157.5 ha) established in 2011 is located in the territory of Javakheti National Park and includes part of the territory of Akhalkalaki Municipality. A natural subalpine forest represented in the surroundings of the Kartsakhi Lake is important in the territory of the Managed Reserve, where the Litvinov's birch, Caucasian mountain ash, cotoneaster, and the shrubs of dog rose and raspberry are presented. It is one of the main routes of birds' migration.

Katsoburi Managed Reserve (area 270.8 ha) established in 1964 and renewed in 2007, is located in Abasha municipality. The area of the Managed Reserve is mainly plain with the maximum height of 40 m above sea level.

The Managed Reserve was established in order to protect the heavily modified remnants of Colchis forests. The main background of vegetation in Katsoburi Managed Reserve is created by the alder trees, where the wingnuts, ash, and others are associated with main forest species. black locusts, alder, and willow are also found in the areas covered by forests.

Ilto Managed Reserve (area 6971 ha) covers the part of the head of the Ilto River gorge in Akhmeta municipality and is located at the height of 900–2000 m above sea level. It was established in 2003 in order to protect and restore the beech forests and the groves of precious species of yew tree, sycamore maple, lime tree, maple, common ash tree, and elm, and the founa characteristic to these forests.

Iori Managed Reserve (2126.8 ha) is located in Gare Kakheti, in Sighnaghi municipality. It was established in 1965 and renewed in 2007. The forests of the Managed Reserve are located in the Iori River gorge. The Managed Reserve was established to protect the floodplain (Tugai) forests. The floodplain forests occupy the first and the second terraces in the river bed. The main forest-producing species are the floodplain oak, the poplar, the elm, and the Mt. Atlas mastic tree. Mountain slopes and plots away from the river are deprived of forest vegetation. Here grow the grains and the individual groves of Jerusalem thorn. The Georgian iris, Eichler's tulip, common barberry, salt cedar, weeping pear, juniper, oriental hornbeam, and others are common here. From mammals here are found wild boar, wolf, otter, reed cat, and others. From birds here are found pheasant, black francolin, partridge, Egyptian vulture, Eurasian magpie, Eurasian jay, griffon vulture, forest owl, and common kestrel; from the reptiles—the common tortoise and macrovipera lebetina.

Lagodekhi Managed Reserve (area 4702 ha) is located in the north-easternmost part of Georgia on the southern slopes of the Caucasus along the villages adjacent to the Lagodekhi Strict Nature Reserve, in the territory of Lagodekhi municipality; It extends up to 590–3500 m above sea level. It was established in 2003, The Lagodekhi Managed Reserve is distinguished with beech-hornbeam broad-leaved forest, with Gurgeniani waterfall; it also includes the system of pathway connecting forests and alpine meadows.

Madatapa Managed Reserve (area1398 ha) is located in the territory of Javakheti National Park. Includes part of the territory of Ninotsminda municipality. It was established in 2011. The Madatapa Lake (Mada) is located in the south-eastern part of the volcanic highland of

Javakheti at an altitude of 2108 m above sea level. There are many waterfowl birds in the summer. Lake banks are low and are covered with hygrophilous vegetation. Madatapa is included in the Madatapa Lake Managed Reserve. During the warm period of the year, a large number of amphibious migratory birds are gathered on the lake.

Nedzvi Managed Reserve (area 9212.5 ha) is located in Borjomi municipality; it includes Nedzvi, Rveli, and Akhaldaba forest lands of the forest fund; it was created in 2007 for the protection of coniferous forests (pine, spruce, and fir trees) in the Nardzikhevi River gorge (right tributary of Mtkvari). Apart from the coniferous trees, there are also wide leaved forests. Winter is moderately mild and with little snow. The thermal mineral water springs (boreholes) are located in the Nedziviskhevi River gorge with the temperature from 32.50 to 44.80. The mineral waters are used in the form of baths.

Sataplia Managed Reserve (area 330 ha) is located in the Tskaltubo municipality in Imereti region, where the footprints of both the predator and herbivorous dinosaurs of different epochs are found. The dinosaurs of Sataplia differ from the world's famous species and are known as "Satapliazaurus". It was established in 2011. There is a dinosaur footprint conservation construction in the territory of the Managed Reserve, as well as the Sataplia karst cave, Colchis forest and rare and endangered timber trees included in the Red List of Georgia, almost half of which is relic.

Sulda Managed Reserve (area 309.3 ha) is located in the territory of Javakheti National Park. It includes part of Akhalkalaki municipality territory. It was established in 2011. Birdwatching and riding on horseback are available there. Family guest houses are functioning in the village of Sulda. The Sulda wetland Managed Reserve area is a Ramsar site similar to four other managed reserves of Javakheti Protected Areas.

Kobuleti Managed Reserve (area 466.3 ha) is located in Achara Autonomous Republic, along the Black Sea, in the north of Kobuleti city. It was established in 2011. There are unique wetlands on the territory of the Managed Reserve. It is distinguished by the diversity of waterfowl birds and plants. By the botanical point of view, the following species are interesting here: sphagnum, or white moss, and insect-eating sundew.

The Kobuleti Protected Area includes the Ispani peat deposit. The Shavighele and Togoni Rivers flow through the territory of the Managed Reserve. Climate is typical marine, humid subtropical with annual rainfall of 1500–2500 mm.

"Ispani II" is located in the Kobuleti Managed Reserve, which is the unique percolating domed wetland of the world's importance, which is fed only by rainwater. The general background of the wetland is formed by peat mosses—the sphagnum species, the so-called "Imeretian sedge", white rhynchispora, peat sedge, water clover, round-leaved drosera, and others.

The Managed Reserve is distinguished with diversity of migratory waterfowl bird species. There are found many species, included in the "Red List" of Georgia (5 species) and Europe scales (28 species) rare and endangered species, such as European bee-eater, kingfisher, little cormorant, yellow heron, ibis, black stork, and others. Here are represented seven species of globally endangered birds, such as: Valley Montagu's Harrier, Lesser Kestrel, field lawping, great snipe, corncrake, and others.

Kobuleti Protected Areas are distinguished by the variety of species of waterfowl migratory birds.

Visitors in Kobuleti Managed Reserve have the opportunity to conduct educational and scientific tours. It is possible to rent wetland skis and walk on a peat moss.

Ktsia-Tabatskuri Managed Reserve (area 22,000 ha) is located on the volcanic upland of Javakheti in southern Georgia. It was created in 1995 to maintain the vegetation characteristic to the humid climate and to protect the birds that are spread in this area: black and white storks (Ciconia nigra and C. ciconia), common crane (Grus grus), corn crake (Crex crex), and velvet duck (Melanitta fusca) and their habitat—the unique wetlands and high mountain ecosystems. The Managed Reserve also is a resting place for a number of migratory waterfowl birds.

The International Association of Bird Conservation (Bird Life International) granted the Tabatskuri Lake international status of An Important Bird and Biodiversity Area (IBA). Georgia has been proposed the wetlands of Ktsia-Tabatskuri Managed Reserve for inclusion in the list of areas protected by Ramsar Convention due to the high value of wetlands ecosystems existed there.

There are many small and large lakes in this area, but among them the Tabatskuri Lake is notable. The surrounding of the Managed Reserve is also rich in historical monuments. To the north of the Managed Reserve, the thirteenth-fourteenth century's cave monastery Vardzia is located. Managed Reserve has the best conditions for birdwatching, as well as tourism development.

Korugi Managed Reserve (area 2068 ha) is located in the south-eastern part of Georgia, in the territory of Sagarejo municipality of Kakheti region. It is located in the Iori gorge, on both sides as a narrow strip. It was founded in 1965 and renewed in 2007. The main goals of its creation are: protection, maintenance, and reproduction of unique floodplain forests (Korugi), flora, and fauna.

Chachuna Managed Reserve (area 5200 ha) is located in Dedoplistskaro municipality. It was established in 1965 and renewed in 2007. It was established mainly for the protection of arid and semiarid type of flora and fauna. Flora is quite diverse in the Managed Reserve. Along the river Iori, the Tugai-type floodplain forest is growing, and the fragments of various types of arid light forests, semi-desert and steppe vegetation are presented on the surrounding hills and terraces.

In the Chachuna Managed Reserve, there are important monuments, such as: early medieval Khornabuji fortress ruins, 11th-century Ozaani Ascension Temple, etc.

Khanchali Lake Managed Reserve (area 727.3 ha) is located in the territory of Javakheti National Park, in Ninotsminda municipality, in the central part of the volcanic highland of Javakheti, at the height of 1928 m above sea level. It was established in 2011. The area of the surface of the lake is 13.3 km and the area of its basin is 182 km^2; the maximum depth is 0.8 m, and the water volume is 6.4 million m^3. The lake basin, especially its southern part, is characterized by a rather dense hydrographic network. The lake is rich in algae. During the warm period of the year, a large number of waterfowl and amphibious migratory birds that are the object of protection gather on the lake.

There are currently two Protected Landscapes in Georgia. The first Protected Landscape –the "Tusheti protected Landscape" was established in 2003 (31.518 thousand hectares), and in 2009—"Kintrishi Protected Landscape" (3.190 thousand ha). In this type of Protected Areas a sustainable use of natural resources and development of eco-tourism is possible in order to facilitate the achievement of conservation aims.

Tusheti Protected Landscape (area 27.903 ha) is located in the territory of Akhmeta municipality in 2003 and includes all the villages of Tusheti. It is designed to maintain the traditional appearance of Tusheti villages and preserve historic-cultural and natural-cultural landscapes, and at the same time, encourage tourism and traditional economic industries without damaging the environment.

The Tusheti Protected Landscape is distinguished by the beautiful historical villages of Tusheti. In the villages of Tusheti there are unique monuments of cultural heritage maintained, as well as the former villages, samples of folk handcraft, agricultural tools, and household items. In terms of spectacularity, Tusheti differs greatly from other Protected Areas, because there, along with the natural monuments, the historic and cultural buildings, traditions and customs are considerably combined. That is what attracts most the visitors there.

Kintrishi Protected Landscape (area 3190 ha) was established in 2007 based on Kintrishi Strict Nature Reserve. The Kintrishi Protected Landscape is located between the Black Sea and Achara-Imereti mountain system; these mountains hinder the sea moisture and determine Kintrishi's highly humid climate. Throughout the year there fall almost as much precipitations (3000 mm), as on the coast of Achara. It was established for protection of

Colchis flora and fauna of the Tertiary age. Many endemic and relic species of plants have been preserved. The subtropical vegetation belt (500 m) is altered by the oak-hornbeam (500–1000 m) and oak (1000–2000 m) belts; higher can be found the subalpine light forest (2000–2200 m) and alpine meadows (2200–2600 m). Strandzha oak, gray alder, hornbeam, yew, box-tree, pontic oak, Medvedev's birch, guelder-rose, buckthorn, mountain ash, thyme, juniper, and others are found there. Animals—roe, chamois, bear, res fox, marten, wildcat, least weasel, Caucasus viper and Caucasian salamander, tetrao, and Eurasian woodcock. There are many trouts in the rivers. Two tourist routes are located at a height of 300–2000 m above sea level on the territory of the Protected Landscape. Movement on the path is possible both on foot and by horse. The picnic and camping areas are organized along the route; the areas for making bonfires are also allocated.

The special phenomenon of nature is the nonlife (inorganic) monuments of nature, which are scattered throughout the different parts of Georgia in big amount. Three groups are distinguished among them: geomorphological, geological, and hydrological. They include the unique karst caves, displaced glacier and mudflow boulders, natural bridges, canyons, waterfalls, vaucluse springs, travertines, fossil elements of flora and fauna, as well as the old trees, such as: 1200 years old three yew trees in Tsedisi Village (Oni municipality), 800 years old plane tree in Telavi, zelkova of the same age in the village of Chkhari (Terjola) and others.

Due to the diversity of natural conditions of Georgia, many interesting monuments of nature have been created during the centuries; monuments of nature are the phenomena equal to the national treasure. All regions of Georgia are very rich in all the wonders of nature. Many of them deserve great attention because of their grandiosity and beauty.

The first three nature monuments in Georgia were established in 2003 with the total area of 314.5 ha. These are: Alazani floodplain (area 204.4 ha), Artsivi gorge (area of 100.4 ha), and Takhtitepa (area 9.7 ha) nature monuments. At present 42 objects were granted status of nature monuments. As of 2018, the total area of nature monuments is 2941.43 ha.

17.1 Karst Caves

Today there are about 1400 caves in Georgia, the total length of which is 275 km and the depth is 80 km (Tsikarishvili and Bolashvili 2013). Tskaltubo Cave (total length 15.5 km) occupies the first place according to the length in Georgia (and in the Caucasus). The length of Akhali Athoni Cave is 3.3 km, but by volume, it is one of the largest in the world (1.5 million m^3). According to the cave floors, Tsutskhvati Cave is the first in the world (1113 floors).

According to the depth, the first place in the world occupies the Krubera abyss (Apkhazeti), where the Ukrainian speleologists registered the depth of 2197 m. Among the deepest caves in the world that are over 1000 m deep, other cave-abysses of Georgia are listed too: Sarma (1830 m), Snowy-Mezhen (1753 m), Pantyukhin (1508 m), Ilyukhuin (1275 m), "Moscow" (1125 m), Arabika (Kuibyshev/Heinrich bottomless, 1110 m) and Dzou (1090 m).

In Georgia, the well-equipped caves are: Akhali Athoni, Tskaltubo (Prometheus) Sataplia, and Navenakhevi.

As for the volcanic caves, their number is not much in Georgia; Dashbashi Cave is important, where the rare forms of lava speleothems ("shelves") are preserved; Phinezauri fortress-cave is also notable with preserved lava "orghan pipes", etc.

Clastokarts caves are predominantly distributed in Samegrelo, where they are related to the Upper Tertiary conglomerates and sandstones. The clastokarst caves are: Nazodelavo, Kalichona, Garakha, Kortskheli, Savekuo and others.

Today the status of Nature Monument in Georgia has been given to 19 caves:

The Bgheri Cave Nature Monument is located in the neighborhood of the Melouri Village, Tskaltubo municipality, at 458 m above sea

level. The nature monument is a cave with the length of 1700 m and the area of 14,000 m^2, which has been generated by the Bgheristskali River in thin and medium-sized limbs of subage The river will eventually cross the entire cave and the thin and medium-layered limestones of Lower Cretaceous Age. The river crosses sects the entire cave and disappears at its western end in debris and siphon of small depth. Trace of the erosion effect of flows is well observed in the Bgheri Cave.

Didghele Cave Nature Monument is located in Tskaltubo municipality, In the neighborhood of Melody Village, at 418 m above sea level. The cave is generated in the by the Osunela River in the Barremian limestones. There are plenty of boulders, clay deposits, etc., fallen from the cave ceiling. Through the crack at the entrance of the cave, the Kinkile stream leaks, and the temporary lake is formed.

Tetra Cave Nature Monument is located in Tskaltubo municipality, in the northeast, 1.6 km away from Tskaltubo, at 140 m above sea level. The cave is 25 m long and 3.5 m high generated in the Lower Cretaceous limestones distinguished with speleothems. It is interesting for diversity of old siphon channels. The cave is distinguished with healing properties. In the past century, patients with bronchial asthma and hypertonia were treated. It is an important archaeological monument, where the remnants of cave bear, deer, bison, wolf, fox, and rabbit bones are found, as well as the remains of ceramics.

Iazoni Cave Nature Monument is located in the city of Kutaisi, in the southernmost part of the Tskaltsitela canyon, at the bridge of the Godogani Village, on the right bank of the Tskaltsitela River, at 135 m above sea level. The cave is 40 m long and at the end, it is blocked by debris. The cave is inhabited by many troglobiont animals. The animal bone and flint tools found here indicate that the cave was a dwelling for humans of the Paleolithic Age.

Melouri Cave Nature Monument (Fig. 17.5) is located in Tskaltubo municipality, in the neighborhood of the Melouri village, at 418 m above sea level. It is one of the largest caves in Georgia. At the end of the halls, the canyonic gorge is stretched at several kilometers, where a permanent stream flows. This stream forms whitewater and waterfalls while flowing through the canyon, and in the final section creates the siphon lake. Stalactites and large size stalagmites are characteristic for the front section of the cave. The cave is inhabited by bats, spiders, and beetles. The cave has a number of unknown corridors and sub-corridors, the study of which is the subject of additional research.

Motena Cave Nature Monument is located in Martvili municipality, in the vicinities of the village of Balda, at 473 m above sea level, on the left bank of the Abasha River gorge. It is a two-storied cave with permanent stream, which conflows the Abasha River. Here is built the stone wall with embrasures. Here are many stalactites, stalagmites, travertine cascades, curtains, and large boulders, as well as local weathering materials. Spiders and other insects inhabit the cave. The historical building was used as a fortress in the Middle Ages.

Nagarevi Cave Nature Monument is located in the area of Godongani Village, in Terjola municipality, on the left ban of the Cheshura River at 199 m above sea level. It consists of narrow corridors and small halls. The front part is two-storied. A small stream occurs at junction of terraces. During the rains, it is completely filled with water. The cave is easy to pass. In some places, one needs to creep.

Navenakhevi Cave Nature Monument is located in Terjola municipality, in the area of the Natengkhevi Village at 320 m above sea level. It is a 250-long two-storied and 4-hall cave distinguished by distinctive and nice-shaped stalagmites, stalagnates, and stalactites. The cave is divided into two parts at 30 m from the entrance. The second floor is connected with the hall by small stairs. The cave does not have the exit; it is closed with a stalagnate with thickness of 7 m.

Nazodelavo Cave Nature Monument is located in Chkhorotsku municipality, in the surrounding areas of the Akhuti (Lemampore) Village, in the Zana River gorge, at 290 m above sea level. The nature monument, the largest clastokarst and pseudokarst 600 m long cave,

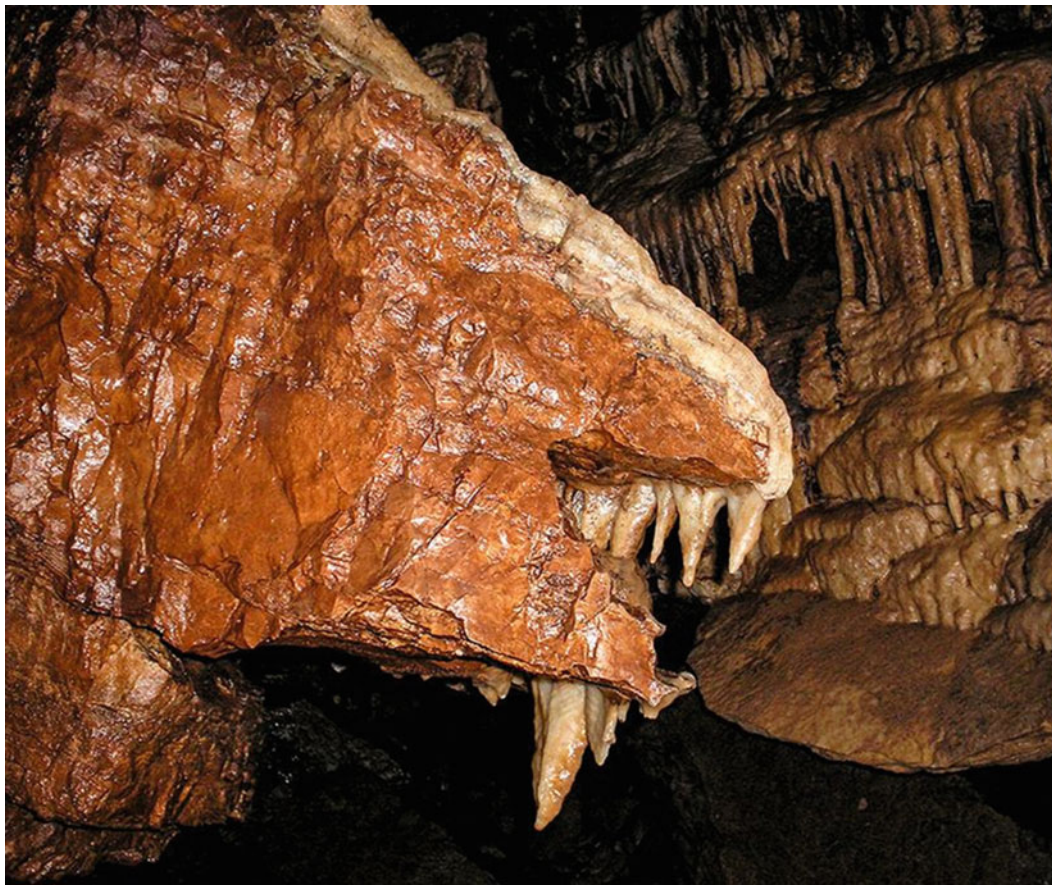

Fig. 17.5 Melouri cave (Photo by R. Tolordava)

generated in Meotian conglomerates, is one of the distinctive caves in Georgia with its parameters. A long and cold underground river flows through the erosive canyon cut into the bottom of the main corridor of the cave. The depth of the canyon reaches 78 m in some areas.

Oniore waterfall (Fig. 17.6) and Toba 1st Cave Nature Monument are located in the northeast of the Meore Balda Village of Martvili municipality, in the gorge of the Toba River– the right tributary of the Abasha River at 680 m above sea level.

The complex of nature monuments is a combination of Toba 1st Cave and the Oniore waterfall falling from the cave. The cave is generated in the Upper Cretaceous layered limestones. The entrance (12 m × 5 m) is opened along the cliff. There is a 21 m high underground waterfall 70 m away from the entrance, where the height of the ceiling is over 30 m. The width of the tunnel reaches 1215 m in some areas. The underground river flowing out from the cave forms the 67 high Oniore waterfalls after 15 m.

Prometheus Cave Natural Monument is located in Tskaltubo municipality, in the territory of the Kummavi Village, at 175 m above sea level. The cave is distinguished by the most beautiful speleothems; there are found stalactites, stalagmites, stalagnates and helictites of particular forms, stone waterfalls, and hanging stone curtains. The cave area is 46.6 ha. The "Prometheus Cave" is characterized by wide corridors, unlike other caves. Here are 17halls of different sizes. The length of the path in the cave is 1.420 m, and the total length of the cave is

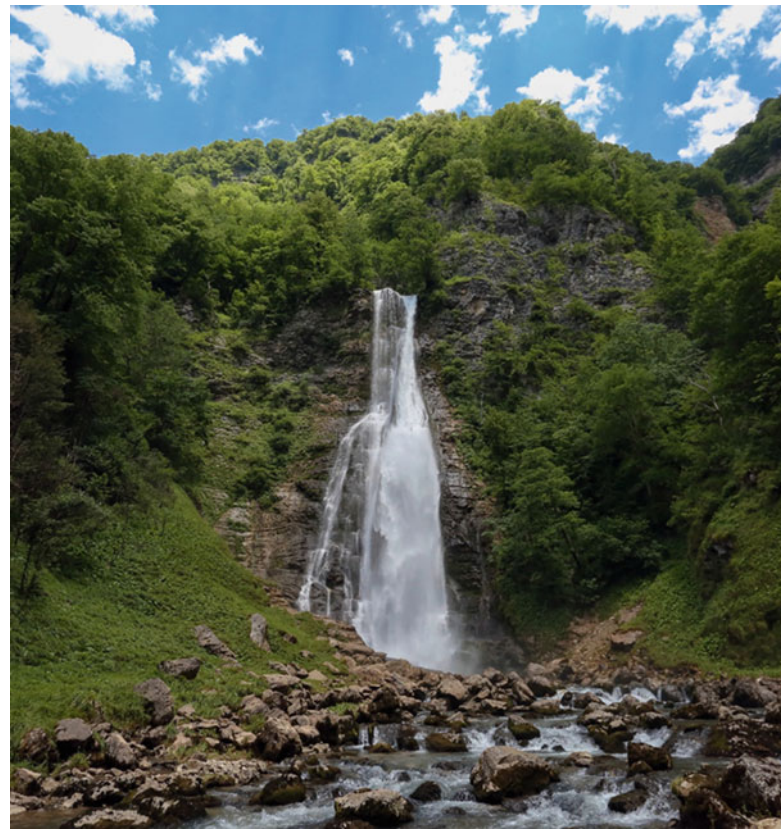

Fig. 17.6 Oniore waterfall (Photo by Agency of Protected Areas of Georgia)

20.000 m. The cave has two exits: one is ended with the river on which the boating is possible, and the second exit is pedestrian and it goes out of the cave hall.

Sakazhia Cave Nature Monument is located in Terjola municipality, in the area of the Godongani Village, on the left bank of the Tskaltsitela River gorge, at a distance of 1.5 km southwest from the Motsameta monastery, at 204 m above sea level. It is a cave rich in archaeological, paleobotanical, and paleozoological findings. Signs of the Paleolithic period have been confirmed in the Caucasus for the first time, where there are a number of representatives of paleozoologic ungulates (bison, deer, and roe deer), predators (cave bear, cave lion, lynx, etc.) and rodents (otter and porcupine). The quantity of animal teeth and bones obtained there has reached several tens of thousands. This material belongs to the Upper Paleolithic.

Satsurblia Nature Monument is located in Tskaltubo municipality, in the neighborhood of the Kummavi Village, on the left bank of the Sami River, at 287 m above sea level. It is a cave rich in stalactites, stalagmites, travertines, and other speleothems of large size. There is a 5-m cliff in 125 m from the entrance, which is followed by a large hall (30X25). In the Middle Ages, the cave was used as a shelter.

Solkota Cave Nature Monument is located in Tskaltubo municipality, in the neighborhood of the Kummavi village, on the left bank of the Sami River, at 379 m above sea level. Particularly large sizes of speleothems attract attention. The circumference of stalactite, which is cut off from the ceiling by the force of gravity, is 5 m. Stalactite of this size is rare in Europe. At a distance of 160 m from the entrance, the 8-m stalagmite is erected from the bottom of the bed, with a circumference of 8.5 m at the foot and

4.5 m in the middle. The cave is also a paleontological monument, as the bones of cave bears were found here.

Toba Waterfall and Arsen Okrojanashvili Cave Nature Monument are located in Martvili municipality, in the northeast of the Meore Balda Village in the Toba gorge –the right tributary of the Abasha River, at 707 m above sea level. The cave is hard to access and it is not recommended to go there without special equipment, and to travel inside, the rubber boat is needed. There are several halls in the cave. Among them, the following are notable: "Nona Hall", "Nana Hall", "Salon", "University 50", "Tbiani", and other halls. Chemical deposits are presented in diverse forms. The height of one of the stalagmites reaches 7 m. The total length of the cave is 1300 m. The river flowing from the cave that forms the four lakes under the ground, generates 234 m high (the highest in Georgia) Toba cascade waterfall.

Ghliana Cave Nature Monument is located in Tskaltubo municipality, in the Kumistavi Village, adjacent to Prometheus Cave, at 142 m above sea level. At almost all length the ceiling is covered with speleothems. This watery gallery generates several siphon passages to the end of the cave and at the end, the 2030 m long passage is very difficult to pass because of the low ceiling. The debit of the underground stream of Ghliana is 5055 l/s. (during low water); this stream joins the vaucluse springs of the Kumi River after flowing out from the cave. In the dry corridors of the cave, there inhabit numerous colonies of bats.

Tsutskhvati Cave Nature Monument is located in the south of Tsutskhvati Village of Tkibuli municipality, in the Chishura River gorge, at 320 m above sea level. The cave consists of 13 floors. The first floor from the bottom of the floor is a narrow hole impassable for the man, through which the permanent stream—the Shabatghele flows. The second floor (main tunnel) is characterized by the features of enormous natural tunnel (length—200 m, width—1030 m, and height—1028 m). The water flows through it only during the flooding of Shabatghele. The remnant of the old cult building with the beams fixed by human is preserved at ceiling. Archaeological monuments from the Middle Paleolithic (from the Moustier epoch) to the Bronze Age and historical epoch, as well as the bones of animals of more than 40 species, have been found there.

The Tsutskhvati Cave is one of the first in the world in its age and number of floors.

Khomuli Cave Nature Monument is located in Tskaltubo Municipality, in the neighborhood of the Khomuli Village, at 160 m above sea level. There is a lake originated by sinking of the surface in front of the cave entrance with the depth of 5 m and circumference of 30 m. The cave is divided into two parts with a 4-m stair. The front part is extensive with sinkholes on the bottom. The second part is a narrow hole, moving is only possible by creeping. The cave is dry. The footprints of temporary flows are observed. There is a small lake at the end of the tunnel.

Jortsku Cave Nature Monument is located in Martvili municipality, in the northeast of the Meore Balda Village, in the gorge of Jortsku—the left tributary of the Abasha River at 653 m above sea level. It is a two-storied cave with a stream flowing into the cave, which is joined by the second flow and after passing the 15 m, it flows out as a spring on the left side of the Jortsku River. The cave is interesting with its characteristic fauna and paleontological specimens, and at the same time, it was the dwelling for people. Here are found the bones of the cave bear, lynx, bisons, and other animals.

17.2 Canyons and Gorges

The canyons of the rivers of Georgia are of different depths, shapes, and distributions. Most parts of the rivers have deep rock gates and canyons on certain sections. One of the deep canyons is Akhatskha in the Bzipi River gorge (Gudauta municipality) with the depth of 200 m and the width—78 m. Important canyons are as follows: Abasha (Martvili municipality), Iupshara (Gudauta municipality), Okatse (Khoni municipality), Kvirila (Chiatura municipality), etc.

Canyon gorges are found in Svaneti too in the lower part of the Mestiachala River gorge. In

the area of Mestia and lower, in the bottom of the Mulkhura gorge, the narrow and very deep canyon is cut, through which the river flows with noise. The upper part of the Enguri River flows through the rock-gate-like gorge. The canyon gorges associated with volcanic rocks are abundant, especially in the Javakheti Upland, Kvemo Kartli—Ktsia (Tetritskaro and Bolnisi municipalities), Dashbashi (Tsalka municipality), Paravani (Akhalkalaki municipality) and others.

Georgia is famous for its gorgeous valleys. In this regard, among them, the gorges of Khde (Kazbegi municipality), Kurtskhana (Adigine municipality), and others are notable, which are distinguished by vegetation, animals, nature monuments, and landscape. At present, there are six canyons in Georgia granted status of a natural monument.

Balda Canon Nature Monument is located in Martvili municipality, in the area of the village of Meore Balda, in the Abasha River gorge near the Balda Monastery, at 295 m above sea level. The nature monument is a canyon generated by the Abasha River in the limestone rocks in the southern part of the Askhi massif. The length of the canyon is 1400 m, width—510 m, and the cut depth—2530 m.

Dashbashi Canyon Nature Monument is located in Tsalka municipality, in the Khrami (Ktsia) River gorge, in the surroundings of the Dashbashi Village at 1110–1448 m above sea level. It is a canyon gorge distinguished by rare biodiversity that was generated in the bed cut in the volcanogenic rocks of the Dabasbashi lava hill by the Ktsia (Khrami) River.

The ecosystems around the canyon are quite poor in vegetation, and the vegetation on the steep slopes of canyon and breathtaking waterfalls create a completely different micro landscape with its characteristic microclimate and peculiar fauna.

Martvili Canyon Nature Monument (Fig. 17.7) is located in Martvili municipality, in the territory of the Gachedili Village in the Abasha River gorge, near the central road of Martvili-Chkhorotsku, at 210 m above sea level. The nature monument is a canyon gorge cut by the Abasha River in the anticline built by the Abedati limestone rocks. The length of the canyon is 2400 m, the depth of the cut is 2030 m, and the width is 510 m.

The natural limestone bridges are preserved in two places in the canyon, which indicates that the karst cave was collapsed here. In addition, in the middle pert of the canyon there are 1215 m high small waterfalls.

Okatse Canyon Nature Monument (Fig. 17.8) is located in Khoni municipality, in the areas of the Gorda Village, at 520 m above sea level. The nature monument is a complex with complicated paleogeographical, geological, and distinguished with particular geomorphological structures, including neotectonic structures, lacustrine deposits, and breathtaking clusecanyon. Its depth is 3550 m and its width—4 m on average; in some areas, the canyon walls almost merge with each other and form natural stone bridges. One of them is "Boga", from where the canyon bottom can be seen.

Samshvilde Canyon Nature Monument is located in Tetritskaro municipality, in the area of Samshvilde Village, near the Samshvilde former town, in the gorges of the Khrami and Chivchavi Rivers, at 548,605 m above sea level. The depth of the canyon cut is 300 m on average and in the middle stream of the Khrami (Ktsia) River it represents the combination of the deep canyon gorge, generated in lava rocks, and the Chivchavi River canyon.

The Samshvilde canyon begins with the outcropped quartz-porphyritic intrusion; as a result of the weathering of these rocks, the magma quartz's beautiful bipyramidal crystals fall on the ground. These crystals of quartz are the true wonder of nature.

An interesting historical monument—the former town of Samshvilde is located near the natural monument.

Tskaltsitela Gorge Nature Monument is located in Kutaisi, Tkibuli, and Terjola municipalities, in the Tskaltsitela River gorge from Gelati Bridge to Godagani Bridge, at 130–200 m above sea level. The nature monument is a beautiful canyon gorge of the Tskaltsitela River, covered with the beautiful Colchis forest. The gorge is of great interest because of the following

Fig. 17.7 Martvili canyon (Photo by R. Tolordava)

Fig. 17.8 Okatse canyon (Photo by R. Tolordava)

monuments of historical culture: Gelati Monastery Complex and Saint Martyrs David and Constantine Monastery.

17.3 Rock Columns and Towers

The rock columns and towers Such formations of relief are often found in many areas of Georgia. All of them are the object of protection. The Katskhi column (Chiatura municipality) (Fig. 17.9) is hard to access as well as the Bodorna column (Dusheti municipality), Sairme cliffs (Tsageri municipality), Kvispapa (Aspindza municipality), Kvakatsa (Shuakhevi municipality), Udabno column (Sagarejo municipality), Betlemisberi (Kazbegi municipality), and others. These forms are generated in almost all rocks. They are found in limestones and conglomerates, volcanic tuffs and sandstones, tuff-breccias, volcanic rocks, and others. Some of them are historically important along their natural features. For example, the Katskhi column and the Bodorian column (5th-6th c.) should be related to the life of the columnar (recluse).

The natural rock columns and towers are much more in the nival belt. Such sharp forms of weathering can be counted in hundreds in this zone.

Bodorna Rock Column Nature Monument (Fig. 17.10) is located in Dusheti municipality in the territory of the Bodorna Village, near the Mtskheta-Stepantsminda-Larsi highway at 796 m. The rock column with the height of 15 m is generated in the Neogene conglomerates, or in the naturally cemented cobblestones. In the lower part of the Bodorna column, there is a double room cave with a niche cut into the wall. 150–200 m away from the column, there is the Bodorna Virgin Mary Church built in the seventeenth century. On the slopes adjacent to the nature monument, there are many handmade caves, which had the purpose of cult or shelter in our historical past.

Sakhizari Cliff Nature Monument is located in Kazbegi municipality, in the Tergi River gorge, in the area of the Sioni Village, at 3136 m above sea level. It is a complex of erosive columns distinguished by interesting geological structure, which was formed on the washed by rich precipitation Mount Kabarjina. The mountain is a flat crested hill of volcanic flow.

Birtvisi Nature Monument is a rocky peak erected on one of the sub-ranges of the Trialeti Range that borders the Algeti River with its slope with two villages: Tba and Pirtskhisi (Tetritskaro municipality). A fortress tower with embrasures is built in the inaccessible rocks; a baptizing pool is cut into the porphyritic tuff. On the way to the Birtvisi peak, the ravine is built out with a wall with embrasures; the walls repeat the words spoken by the man with the remarkable peculiar acoustics.

17.4 Mud Volcanoes

In Georgia, the mud volcanoes are in Kakheti, in the Iori Upland, and on the slopes of the Gombori Range. Among those following are notable: Akhtala, Pkhoveli, Kilakupra, etc. The mud volcanoes are notable for their special forms. Mud, water with gas, and oil erupt from the 1.52 m high cones. Among the mud volcanoes, only the Takhti-Tepa has a status of Nature Monument (Fig. 17.11).

The Takhiti-Tepa Nature Monument is located in Dedoplistskaro municipality, On the right bank of the Iori River, from Dali water reservoir to southwest, at 541 m above sea level. It is a group of craters of mud volcanoes (pseudo or, exo-volcanoes), from which the mixture of water, oil, mud, and gases constantly erupts.

17.5 Travertines

Travertines (lime-tuffs) are formed by the deposition of travertine or lime-tuff. In some areas natural dams are originated in the cave river beds; siphon sections are often associated with those dams. There are especially many travertines in the Motena (Martvili municipality), Tsutskhvati (Tkibuli municipality), Abrskili (Ochamchire municipality), and other caves.

Fig. 17.9 Katskhi column (Photo by I. Julakidze)

Under the open sky, the travertines are predominantly distributed in the Caucasus and its foothills. Especially notable is the upper part of the Liakhvi gorge (Britata travertines), Patara Liakhvi (Atsriskhevi travertines), Lekhura, Ksani, and upper parts of Aragvi. Diverse forms of travertine are found on the northern side of the main watershed range of the Caucasus—in the upper part of Tergi (Truso gorge); the footprints of plants in the travertines here indicate that in the past there were forest plants in this area. In some areas, they are karstified and the atmospheric precipitations have generated small funnels in them.

Travertines are widely spread in the areas of the Jvari Pass, Khevsureti, and Tusheti. In addition, travertines are found in such areas, where the carbonate rocks are not outcropped. For example, in the Kaloani and Arkhotistskali gorges (Khevsureti), at the villages of Juta (Kazbegi municipality) and Dartlo (Tusheti), etc.

Travertines are also widespread in western Georgia including Svaneti (in the Khalde gorge, at Becho), Imereti (Kvirila gorge, below Chiatura), Racha (Kvabtkari, Ambrolauri municipality), etc.

Truso Travertines Nature Monument is located in Kazbegi municipality, Truso gorge, on the right bank of the Tergi River, near the central road, to the south-east from the Keterisi Village at 2093 m above sea level. In many areas, there are heaps of lime travertines deposited by springs in many areas.

There are many travertine "meadows" in the intensive development process, modeled by water. The thin layer of transparent water covers the dazzling white surface of the travertines and forms a lot of small sparkling lakes.

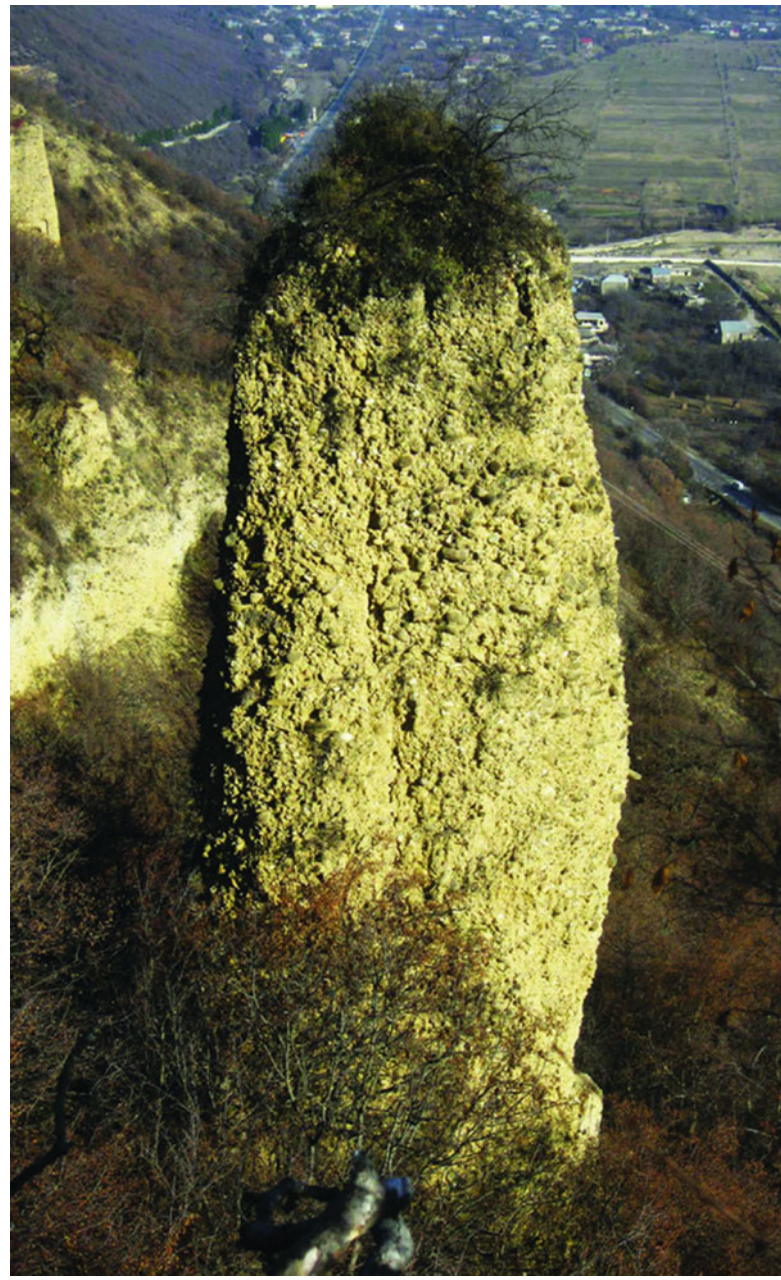

Fig. 17.10 Bodorna Rock Column (photo by K. Kharadze)

Jvari Pass Travertine Nature Monument (Fig. 17.12) is located in Kazbegi municipality, Bidara River gorge, near the Kobi-Gudauri road at 2197 m above sea level. In some places in Bidara River gorge, there are deposits of travertines deposited by springs. One of the most important and breathtaking places of travertines is located on the left bank of the Bidara River near the road tunnel. The transparent water flows down in a thin layer on the white surface of the slope and creates the breathtaking travertine, which is in the intensive development process.

Fig. 17.11 Takhiti-Tepa (Photo by V. Cherkezishvili)

17.6 Displaced Boulders

Displaced boulders, or the erratic (erraticus – Latin, "wandering") boulders. The number of boulders displaced by glaciers and mudflows is considerable after the number of caves. They are one of the most interesting phenomena of nature, which are displaced sometimes even tens of kilometers away. That is why often the huge boulder at any area is composed of rocks that are not characteristic of this area.

The displaced boulders are scattered along the southern slope of the Caucasus, mainly between the Bzipi and Aragvi gorges, and on the northern slopes in Tergi and Arkhoti gorges. A small number of such boulders is found in the highland of southern Georgia –in the Samsari and Erusheti Ranges, etc. Particularly many huge boulders are represented in the upper parts of the gorges of Chkhalta, Nenskra, Nakra, Dolra, Mestiachala, Enguri, Mulkhuri, Adishchala, Tskhenistskali, Rioni, Chveshura, Abudelauri, and Jutaskali. Some of them belong to the largest erratic boulders of the world. Huge boulders are often found in unexpected areas. They are of great importance to determine the boundaries of the old glaciation. They are interesting objects for mass tourism.

Especially interesting is the rolling boulder, namely the limestone boulder "Kvakantsalia" in the Kvira massif (Tsalenjikha municipality).

Roshka Nature Monument includes the Roshkistskali River gorge from the village of Roshka to the direction of the Caucasus. Effective landscapes are created by the slopes of the Caucasus and number of erratic boulders. The two huge diabese (magmatic rock) boulders, represented here, belong to the largest erratic boulders in the world. The relatively small size, but impressive erratic boulders are scattered in big amount in the upper parts of the gorge and in the vicinity of the Roshka Village.

In the territory of the Roshka Nature Monument, visitors are allowed to carry out the

Fig. 17.12 Jvari Pass Travertine (Photo by N.Bolashvili)

nonampunipulatory scientific research and educational activities.

17.7 Fossil Flora and Fauna

Fossil flora and fauna are known in Georgia both by traces of leaves and horns (Kisatibi diatomite) and brilliantly preserved seeds (Apkhazeti; Guria Pliocene deposits).

Georgia is distinguished by the richness of the locations of fossil vegetation. Especially notable is the flora of Jurassic, Sarmatian, Pontian, and Pliocene periods.

The fossil flora's unique location is the "petrified forest" on the eastern slopes of the Goderdzi Pass. The remnants of wood plants are also preserved in Kazbegi municipality, on the right side of Tergi, and in Gori region, in the Atreva gorge.

The country is rich in locations of fossil fauna too. In the vicinity of Kutaisi, near the Sataplia karst cave, on the surface of Cretaceous limestones, there are the footprints of dinosaurs—the giant reptiles, in Dzusa (Terjola municipality) gorge—the footprints of one of the species of crocodile, and in the vicinity of Benara (Adigeni municipality), a rich habitat of Oligocene vertebrates are found. The habitats of Oligocene mammals are: Eldari, Udabno, Arcneti, Iaghluji, etc.

It is interesting to resound among scientists the discovery of Udabnopithecus garedziensis in the areas of Davit Gareji and the remnants of tropical animals and the million eight hundred thousand years old human skulls in the former town of Dmanisi. The relatively young—the Pliocene Age mammals' remnants are found in Kvabebi (Sighnaghi municipality), Bazaleti (Dusheti municipality), Kotsakhauri (Dedoplistskaro municipality), and Tsalka habitats. The most complete in the world skeleton of southern elephant (preserved in the Janashia State Museum) is also found in the Kotsakhuri Range. Rich remnants of the Quaternary fauna are preserved in the Stone Age archaeological monuments, especially in the cave dwellings. In some of them (Sakazhia, Tsutskhvati, Jruchula, etc.), the remnants of the Stone Age human—the Neanderthals are found.

17.8 Flora

Alazani Floodplain Natural Monument is located in Dedoplistskaro municipality, on the right bank of the Alazani River, to the southeast from the village of Pirosmani, at 165 m above sea level. It is represented in the Alazani River bay in the area of 204.4 ha, in the form of the liana floodplain forest of natural origin. There are plenty of walnuts, ash trees, oaks, elms, and a shrub characteristic for floodplain Forest.

Goderdzi Petrified Forest nature Monument (Fig. 17.13) is located in the area of Adigeni and Khulo municipalities near the Goderdzi Pass, close to Batumi-Akhaltsikhe central highway. It is a unique place of petrified flora and fauna of the Pliocene period, which is presented in three sections within the area of the nature monument, at an altitude of 1600–2100 m above the sea level, with a total area of 365 ha. In the outcropped volcanogenic suites, the constituent parts of the petrified forest are visible, which contain the large amount of vegetation remnants of Lower Pliocene Age (palm tree, magnolia, laurel, and others on the one hand, and the willow, birch, hornbeam, and beech on the other hand). The vegetation remnants are seen in a gray volcanic tuff, with petrified and semi-petrified stems and leaves of trees.

17.9 Fauna

Artsivi (Eagle) Gorge Natural Monument is located in Dedoplistskaro municipality, 0.5 km north to the Dedoplistskaro town, at 762 m above sea level. It is a unique complex consisting of two objects. One part is a limestone rocky canyon and the second is the adjacent forest area, where the Khornabuji fortress (5th c.) is located. The canyon, which is distinguished by its beautiful landscape, is inhabited by numerous predatory birds (eagles, cinereous vultures, etc.). On the cliffs of the rocky slopes of the gorge, it is possible to see the nests of the griffon vultures and rare and endangered plants that are not found anywhere on the territory of Georgia (Fig. 17.14).

17.10 Hydrographic Monuments

There are many hydrographic monuments to be protected by the state of Georgia. In addition, most of them are wonderful tourist-excursion objects. Only six lakes, three vaucluses, and five waterfalls are included in the already published "Red Book of Georgia" from these types of monuments. However, dozens of other objects deserve protection and popularization.

17.11 Lakes

860 lakes are registered in Georgia. Their total area is 170 km^2, which is 0.24% of the country's territory. They are fed mostly by snow, rain, and underground waters; therefore, the fluctuation of water level in them depends on the distribution of precipitation.

Highland of southern Georgia is distinguished by the abundance of lakes. The Paravani Lake, the largest in area, is located there. There is also Tabiskuri (Tabatskuri), which is the largest lake in water volume. The lakes of Saghamo, Mada, Khanchali, Kartsakhi, Samsari, Abuli, Zresi, Tsunda, Levangeli, and others are also notable.

The Paliastomi Lake is located in the Kolkheti Lowland, the Ertso Lake—in the lower part of the Tskhinvali-Oni road and the Bazaleti Lake—in the Aragvi gorge. There are several lakes in the Keli plateau, the largest of which is the Keli Lake and Archvebi Lake. Mineral lakes are also found there. Among them are the Britati Lake (Java municipality), Abano Lake (Kazbegi municipality), and others. The Ritsa, Amtkeli, Kvarashi, and other lakes are located in Apkhazeti, TobaVarchkili—in Samegrelo, Kveda Lake—in Racha, Green Lake in Achara and, etc. (Fig. 17.15).

All lakes essentially require protection; however, not all of them are suitable for tourist and excursion purposes. There are 13 lakes with the area of more than 1 km^2 in Georgia and 50 lakes of more than 10 hectares. For tourist and excursion purposes notable are: Ritsa, Bazaleti, Tabatskuri, Tsunda, Bateti, Mtsvane (Green)

Fig. 17.13 Goderdzi Petrified Forest (Photo by N. Kvirkvelia)

Lake, and other lakes. The nature monument status is given to two lakes: Abano Mineral Lake and Gabzaruli Lake.

Abano Mineral Lake monument is located in the Kazbegi municipality, Truso gorge, on the left bank of the Tergi River, in the east from the village of Abano, at 2127 m above sea level. It is a small lake generated by spring with carbon dioxide flowing on the earth's surface from the Upper Jurassic carbonate rocks, which "boils" noisily due to the carbon dioxide gas bubbles. The spring debit is 2.5 million liters a day. The lake area is 0.04 ha. The gas emissions in calm weather cause the accumulation of carbon dioxide in the lower layers of the air. Little animals die when approaching the lake; therefore, here one can find the dead bodies of mice, lizards, frogs, and birds.

Gabzaruli Lake Nature Monument is located in Tskaltubo municipality, in the village of Kumistavi, at 1.7 km northwest of the Kumi vaucluse springs, in the Kumi River basin, at 166 m above sea level. The nature monument is generated in Lower Cretaceous limestones, and the shaft is opened in the form of a crack on the slope covered by deciduous forest. The length of the crack stretched to the north is 60 m and the width is 225 m. On the bottom of the crack, a

Fig. 17.14 Artsivi (Eagle) Gorge Natural Monument (Photo by V. Cherkezishvili)

Fig. 17.15 Tsunda and Green lakes (Photos by K. Kharadze)

45 m deep siphon lake is located at 25 m from the surface. The crack siphon is one of the components of the cave system. The siphon lake level coincides with the level of the outflows of the Kumi River.

17.12 Vaucluses

Vaucluses are high debit springs and their outlets are in many areas. The high debit springs are also known in the territories built by volcanogenic suites too. The first of them is widespread in western Georgia—in the zone of the Caucasus and its foothills, and the lava vaucluses—in Javakheti volcanic highland and the areas built with fissured lavas. Vaucluses are characteristic of the foothills of both sides of the Caucasus in eastern Georgia. The debit of some of them is so high that the mills are built on them as well. For example, a cascade of water mills is built on the stream generated from the Keterisi vaucluse.

Apkhazeti (Mchishta, Reproa, Rechkhi, etc.) is especially rich in karst vaucluses. The Eristavtskali tributary Rechkhi flows out from the foot of the Okhachkue limestone massif in the form of a powerful but variable debit vaucluses. The Vaucluse Rivers are used for population water supply.

Strong vaucluse springs are common in Odishi too. There are many karst vaucluses in territories of the villages of Inchkhuri, Mukhuri (Fig. 17.16), Chkvaleri, Tsachkhuri, Rukhi, Turchutobi and others. The Intsra gorge is also rich in vaucluses (Tsalenjikha municipality). Intsra, by itself, starts from the two karst caves and creates a large waterfall in the heads. The high debit spring flows out at the ruins of the Rukhi fortress (Zugdidi municipality) and Turchobi, the length of the underground section of which reaches 3 km, is the largest manifestation of Samegrelo Karst Rivers.

The vaucluse springs are also found in Imereti; the Tkibula River, which was lost in a narrow tunnel, was flowing out in two powerful vaucluses with the name of Dzevrula River. The Tsutskhvati multistorey cave is now generating a new floor, from where the water flows out in the form of three vaucluses at the foot of the southern slope of the hill with the name of Chishura. There are periodically active vaucluses at the village of Kvatsikhe (Chiatura municipality). The underground karst rivers flow through the tunnels of the caves of Sataplia, Kumistavi, and Kvilishori (Tskaltubo municipality), as well as the Chishura springs, etc.

The lavish vaucluses are in the Javakheti Upland; the strongest springs flow out from the heads of the rivers of Kulikami and Abulistskali and on the banks of Paravani and Saghamo Lakes, especially in the area of the villages of Dlivi and Gandza. The rivers with positive water cycle in these areas receive the excess amount of water at the expense of the other basins, which is caused by the hydrological regime of cracked and porous volcanogenic suites.

The high debit springs are found in the Tsalka basin (springs of Oliangi, Dashbashi, Nardevani, Aiazmi, etc.). In the Truso (Keterisi, Kazbegi region) gorge the vaucluses flow out from beneath of lava boulder, which was named "Narzanvaucluse" by researchers. Its daily discharge is 2530 million liters. Similar vaucluses are also in the heads of the rivers of Didi Liakhvi, Ksani, and Tetri Aragvi.

Keterisi Mineral Vaucluse Nature Monument is located in Kazbegi municipality, Truso Gorge, on the right bank of the Tergi River, in the area of the Keterisi Village at 2168 m above sea level. At the foot of the Caucasus Main Mountain Range, beneath the lava boulders, a group of powerful springs flow out from the Upper Jurassic carbonate flysch that was named "Narzanvaucluse" by the researchers. The spring gives 2530 million liters of hydrocarbonate-calcium water daily, which corresponds to 300–350 l/s. The river originates from that spring that flows across the Keterisi Village, where the cascade of water mills is arranged.

17.13 Waterfalls

The long rivers of Georgia almost do not form high waterfalls. Most of the waterfalls are associated with the old glaciations and the

Fig. 17.16 Deidzakhi Vaucluse (Photo by K. Tsikarishvili)

distribution regions of karst and young volcanoes, and therefore they are mostly represented in the Caucasus.

There are many waterfalls in Apkhazeti. Here, the water on the Klichi River falls down from almost 100 m. Waterfalls are on the left tributary of Chkhalta River and the short right tributaries of the Kodori-Gvandra—on Atsapi, Chkhaltadziri, Ketskvara, etc. There is a great waterfall in Apkhazeti on the Bzipi, Gega, and other rivers. There are also many waterfalls in the Abasha River basin and its surrounding area. Important waterfalls are on the rivers of Turchu, and Toba flowing out from the caves in the Askhi massif. Ochkhomuri (threestep) waterfall is in western Georgia, as well as in the heads of the Intsra River (Fig. 17.17), Okatse gorge, in the heads of Lekhidari, etc. The waterfalls falling down from the caves of Kinchkha and Ghvirisha create rare picturesque view.

There are several waterfalls in the Lagodekhi Strict Nature Reserve in eastern Georgia, as well as at the heads of the Chartliskhevi and Iori Rivers, on Eretostskali—the tributary of the Tetri Aragvi River, on the tributaries of the Tergi River (Arshi, Shtsavali, Gveleti, Khde, etc.); in Kvemo Kartli, in the Gomareti plateau, the Egri (Kaflanishvilis), Kldeisi and other waterfalls. The waterfalls are in the Gujaretistskali River gorge, in the vicinity of Tbilisi, etc. Most of the waterfalls are tourist-excursion objects. They are very impressive for tourists. Sometimes even the rainbow occurs in the water splashes. The nature monument status is granted to the following four waterfalls:

Abasha River Waterfall Nature Monument is located in the Balda Village of Martvili municipality, in the territory of the site of Rachka, in the heads of the Abasha River, at 895 m above sea level in the southwestern part of the Askhi Massif. The left tributary of the Abasha River flows from the cave through the limestone cliff falling nearby from about 40 m. The waterfall generates 12 m diameter pit at the falling area. The water is boiling in the pit. The waterfall sparkles often create a rainbow.

On the right side of the main waterfall, there are two small waterfalls (Fig. 17.18). A 200 m tall limestone cliff overlooks the waterfalls. The nearby areas of the waterfalls are covered by dense forests. The thick groves of box trees attract attention; they are quite difficult to pass

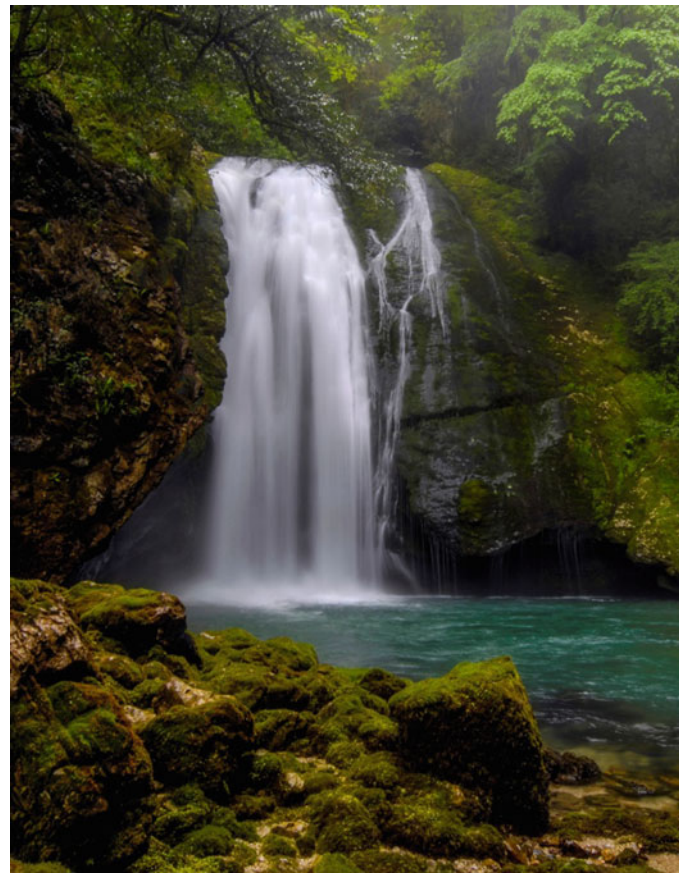

Fig. 17.17 Intsra waterfall (Photo by R. Tolordava)

through. Here is the site Rachkha with a lot of outflows of karst waters.

Mukhura and Tskalmechkhera Waterfalls Nature Monument are located in the vicinity of the Mukhura Village of Tkibuli municipality near the road at 886 m above sea level. The threestep 6070 m high waterfall flows from the cave located at the eastern exposition slope. There is one small and one large lake in the cave (Kharadze 2014). Waterfalls are covered with mixed broad-leaved forest. There are many endemic animals inhabited here, namely: Caucasian mole, Radde's shrew, Volnukhin shrew, and Transcaucasian water shrew (Fig. 17.19).

Okatse (Kinchkha) Waterfall Nature Monument (Fig. 17.20) is located in Khoni municipality, in the neighborhood of the Kinchka village, at 843 m above sea level. It is a threestep waterfall cascade falling from the eastern cliff of the Askhi limestone massif in the Satsiskvilo River gorge. The upper two steps are formed on the right tributaries of the Satsiskvilo River; the height of the first one is about 25 m and the height of the second waterfall reaches 70 m. After joining the stream with the Satsiskvilo River, in 20 m the third 35 m high step of the cascade is formed.

Ochkhomuri Waterfall Nature Monument is located in Martvili municipality, in the north of the Kuruzu Village, at 550 m above sea level, in the southern part of the Migaria limestone massif, in the heads of the Ochkhomuri River. The height of the three step cascade is 100,120 m. Every step of the waterfall develops small lakes at the bottom while falling down. The moisture around the waterfall causes the development of a peculiar flora and fauna in its surrounding areas, where there are many rare, endemic or relic species; the box-tree groves are important there.

Fig. 17.18 Abasha river canyon (Photo by R. Tolordava)

17.14 Nature Sightseeings

In Georgia, in addition to the above-mentioned natural monuments, there are many other interesting nature sightseeings that can be granted the status of natural monuments in the future, such as natural freezers, volcanic forms of relief, natural bridges, etc.

Natural freezers are found in almost every part of Georgia—in Shida Kartli and Kvemo Kartli, Racha, and Javakheti, Samegrelo and Apkhazeti, Achara and Samtskhe, etc. Morphological peculiarities of natural freezers and conditions of origin are different. The main sign is that all of them are producing ice in summer season.

Natural freezers in eastern Georgia are mainly found in small pockets of destructed volcanic structures; sometimes they form complex labyrinths; typically, the size of such freezers is not very large (depth is 1.5–2.5 m, sometimes even smaller, and diameter is from 80–130 cm to 30–50 cm).

Natural freezers in western Georgia are largely related to karst wells and caves. Snow falling in winter and spring here often become in firn and ice.

Natural freezers are formed due to a certain match of the relief and climatic conditions of the site. These monuments of nature are rare formations created for thousands of years and have scientific and aesthetic significance.

Volcanic terrain forms are best presented in southern Georgia. In addition, these forms are found in Achara-Trialeti mountain system, Zemo Imereti plateau, and the Caucasus region. They are presented in cone and dome mountains, plateaus and streams, etc. Extensive lava plateaus are the Akhalkalaki, Kvemo Kartli, Gomareti, Keti and other plateaus.

In contrast, the lava flow is of elongated form and sometimes are extended to considerable distance: the flow from Javakheti Range extends at about 120 km and goes to the village of Ilmazlo (Marneuli municipality), the right bank of the Mtkvari River. In addition, the remnant of dolerite flow is known at the village of Kakliani

Fig. 17.19 Tskalmechkhera waterfall (Photo by K. Kharadze)

(Dmanisi municipality), as well as the lava streams flown from the Javakheti Range and Bakuriani, also the lava streams of Gujareti, Khorisari, Tkarsheti, and Kaishauri.

The following volcano centers are notable in the Keli Upland: Didi Khorisari (3830 m above sea level), Mtsire Khorisari (3741 m), Didi Mepiskalo (3694 m), Patara Mepiskalo (3536 m), Keli (3628 m) and others.

Badlands and cuestas. Badlands are formed in the areas with arid climates due to the influence of atmospheric precipitations and temporary streams on waterproof clay rocks. In Georgia, the badlands are common on the southern slopes of Kvarnakebi (Shida Kartli) and in the eastern part of Gombori Range.

Cuestas (the asymmetric hills) are well-expressed in the karst regions of Georgia; they are also found in the area of Tbilisi.

Layer disorders (olistostrom). Example of **layer disorders** or 'olistostrom' is the Middle Eocene sediments in Tbilisi and its surroundings, which is crowned by the boulder-breccias of very peculiar nature that was named „conglomerates with layer disorder "by Hermann Abich (1870). Within the city, these formations construct the left rocky bank of the Mtkvari River in the rock at the Metekhi Cathedral. The „conglomerates with layer disorder" are located in the arch part of Mamadaviti anticline and cover the upper part of the Middle Eocene.

Fig. 17.20 Okatse (Kinchkha) waterfall (Photo by Agency of Protected Areas of Georgia)

Pseudokarst. Such forms of relief only externally resemble karst forms. Their distribution is related to noncarbonated rocks. The pseudokarst (Fig. 17.21) in Georgia is quite common. Terrestrial forms in the form of sinkholes, wells, caves, natural bridges, and other forms are created in the areas of Tbilisi (Zahesi, Gldani vicinities), Marneuli Plain, Algeti-Ktsia lower part, Kvernaki (Kaspi municipality), Iori Upland, Alazani Gorge (mainly in clays), Gldani areas (in sandstones), etc.

Corrie fields. Corries or serums are the limestone surfaces dissected by the chemical impact of water and corrosion that are characterized by the surface microforms. They are widespread in western Georgia; especially interesting are the limestone valleys spread in the Arabika, Bzipi Range, and other limestone massifs.

Physical-geographical conditions have played a major role in the occurrence and evolution of corrie gorges of high mountain massifs. Among them, we should name the leveling of the crest of the limestone massif by Quaternary glaciers and heavy fissuring of rocks, in which the severe climatic conditions (temperature and frosts, etc.) have a great role along with the tectonic tension.

Cryogenic forms. The cryogenic forms of relief (hillocks, solifluction terraces, polygone formations, stone runs, etc.) are characteristic to the highlands of Georgia. One of the widespread forms—the stone run is characteristic to the Javakheti highland, on the slopes of which there are the "stone seas", "stone rivers" and "stone fields" formed by weathering processes.

Natural bridges. A peculiar formation of nature—the natural bridges are characteristic mainly for karst regions. Once in these places the ceiling of the bed of the underground river flowing through limestones was collapsed and washed due to the action of erosive and gravitational forces, and the only bridge-like narrow strip and its pillars were preserved.

There are several natural bridges in Georgia. Among them, the notable are: the Semi-bridge on the rivers of Semi (Tskhenistskali left tributary, Tskaltubo municipality), Kheori, Pshitsa and Akhatskha. A small natural bridge is located at the Cherami rocks, on the river of Mshrali Khevi, etc.

Fig. 17.21 Pseudokarst, Tbilisi (Mukhatgverdi) (Photo by K. Kharadze)

In the two places of Abasha canyon the remains of natural limestone bridges are preserved; this circumstance confirms that the canyon is partially formed due to the destruction of karst cave ceiling. A peculiar "bridge" is in Racha as well, on the Shareula River, in the area of the Gogoleti Village (Ambrolauri municipality). The gorge is narrowed and the limestone boulder fallen from the cliff turned into a bridge.

Rapids and erosive islands. Rapids—the low water and whitewater sections of the river are found on the Rioni River, Chakvistskali River, etc. and the erosive islands are found in the rocks forming the bed due to the destructive effect of water stream; this monument of nature formed in Kutaisi, is the object of aesthetic enjoyment besides the fact that it is interesting from scientific viewpoint.

Landslides. Landslides occur in different conditions and at different stages of development; they occur more frequently while the alternation of the waterproof (clay) and the water content rocks. The landslides of Sairme, Lailashi, Tsablana, and others are known for their power.

Agate ore. Agate is found in the area of Shurdo Village (Akhaltsikhe municipality). Agate belongs to the so-called quartz group (flint). The existence of the ore is associated with the transformed black andesites of the Tertiary Age, which is cut in the sedimentary rocks like a wedge and is extended over a long distance. Here agate is colorful—black, brown, blue, red, pink, honey, light gray and, etc. In addition, its forms are also diverse. One of its interesting sites is to be protected.

Agate has been known in Georgia since the Bronze Age. It adorns the items discovered in Trialeti, as well as the items discovered in the Bronze Age Cemetery on the "Amirani hill", at Akhaltsikhe, etc. Especially in large quantities are found the agate item in the Antique Time monuments. Currently agate is used for making the most accurate devices, namely, in geophysical equipment, in the artificial satellites of the Earth and in the clock industry.

Crystals. crystals are fascinating creations of inorganic nature.

Mountain crystal is related to quartz veins in the slate regions of the Caucasus.

Interesting quartz crystals are characteristic to the area at Samshvilde (Tetritskaro municipality), on the right side of the Chivchavi river, at an altitude of 820–860 m above sea level. They are found in Kazbegi municipality, on the both sides

of the Tergi River from the village of Kobi up to the Dariali gorge. The mountain quartz is also common in the Khde gorge (Kazbegi municipality), Shodakedela Range (Oni municipality), Svaneti, Khevsureti, etc. Quartz sand can be found in the areas of Khashuri, Chiatura, and Kharagauli municipalities, quartz crystals—in the Bolnisi municipality, etc.

Samshvilde quartz crystals. At Samshvilde, there are plenty of hexagonal bipyramidal crystals of quartz, which are found in great amounts into the quartz-porphyritic outcropped intrusion. As a result of the weathering of these rocks, the magma quartz's beautiful bipyramidal crystals fall on the ground. A large number of crystals of magma quartz are splashed in them, which was noticed by Georgian scientist Vakhushti Bagrationi in the beginning of the eighteenth century.

Jewelry and souvenirs can be made from crystals. They can be applied in technique. Moreover, their industrial mining is not allowed, because it is a protected object and is included in the "Red Book of Georgia".

Bodorna molasses deposits. Georgia clod (the crystalline substrate) is deeply sunk at 700–1000 m above sea level on the left section of the Georgian Military Road in the Bodorna Village, and covered by the Upper Eocene—Lower Mio-Pliocene molasses deposits that are particularly well outcropped at the village of Bodorana (Dusheti municipality). Vertical walls are constructed with noncategorized conglomerates with clay lenses in them. Mollasses deposits end at the village of Zhinvali. Its maximum thickness is up to 2 km. The Bazaleti Lake is located on these deposits.

Gordi Pleistocene lacustrine deposits is located in the east of the village of Gordi (Khoni municipality), in the Okatse River gorge (the right tributary of Tskhenistskali), at 520 m above sea level.

The Okatse gorge was blocked by a tectonic thrust in the Middle Quaternary Period and made a lake in it. In the lake the clay sands were deposited, the thickness of which exceeded 27 m. After tens of thousands of years, the water found the exit in the limestone fissures, expanded it, and the lake was emptied. The washing of the lacustrine deposits started and the canyon was formed, and the lacustrine deposits remained only in some places. The seasonal stratification is well represented in the deposits. Each pair of the layers corresponds to one year. Palinological study of the deposits (the microscopic research of the dust and spores of fossil plants) revealed the remnants of the disappeared species of ancient flora that are preserved in the lower part of the suite—bald cypress (*Taxodium distichum*), Engelhardtia, cedar (*Cedrus*) and others. According to the analysis of plants stamens, after 500–600 years from the lake occurrence, there was a sharp falling in air temperature in the area of Gordi, which led to the total extinction of heat-loving species.

According to these deposits, scientists have the opportunity to find the peculiarities of the Quaternary Period—the last phase of the Earth's development history.

Jgali Miocene deposits. Outcrops of rocks interesting in the geological and paleontological terms were detected and described in 1934 in the site of Maidan at the village of Jgali (Tsalenjikha municipality) in the Tsertskari River gorge. The deposits contain rich remnants of mollusks' fauna. It is unique not only in Georgia but also in the Caucasus and Mediterranean Sea basins. The Lower Miocene, Middle Miocene, and Upper Miocene (several layers) are represented in the section of the Tsertskari gorge Miocene deposits that are located between the Maikop suite's (Oligocene) jarosite clays (underneath) and Meotian-Pontian conglomerates (they are placed on the Upper Miocene-Sarmatian).

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