APPLICATION DOSSIER FOR MEMBERSHIP IN THE EUROPEAN GEOPARKS NETWORK

Annex 2
Separate copy of section B, “Gelogical Heritage” the application, perface – Geological summary

IDRIJA GEOPARK

Idrija – November 2011
The **entire area of the Idrija Geopark** is characterised by a remarkable variety of geological features. The oldest rocks in the Idrija Geopark are of Palaeozoic, Carboniferous and Permian age, followed by all Triassic and partly Jurassic and Cretaceous lithological sequences, covered by Palaeocene-Eocene flysch beds. As many as 37 lithostratigraphic units have been identified. Alongside the variegated carbonate and clastic sediments, richly developed pyroclastic rocks and outcrops of igneous rocks can be found.

Due to intensive Middle Triassic tectonic activity and extensive Tertiary thrusting, the rocks in the Geopark have highly complicated mutual relations. Single and triple tectonic windows, the morphologically very well expressed Idrija fault, unique hydrological-karst phenomena, the world famous Idrija mercury ore deposit with its exceptional sedimentary cinnabar ores and native Hg, a Locus typicus for numerous fossils and minerals, rank the Idrija Geopark among the most interesting and complex geological regions in this part of Europe.
**B. GEOLOGICAL HERITAGE**

**B1. LOCATION OF THE PROPOSED GEOPARK**

The nominated area is defined in section A. The Geopark lies between 13° 50’ E and 14° 08’ E and between 45° 52’ N and 46° 12’ N.

*Fig. B1* – Geological map of Idrija Region (Čar, 2010). Drawn by Staša Čertalić
B2 GENERAL GEOLOGICAL DESCRIPTION OF THE PROPOSED GEOPARK

Geological investigations have been conducted in the Idrija region for the past 250 years, which is at least one hundred years longer than in other regions of Slovenia, so it is not surprising that the foundations of Slovenian geology were laid in Idrija (Čar, 2010). The reason for this is the Idrija mine, the second largest mercury mine in the world. The mine was discovered in 1490 and, throughout its five-hundred-year history, has been the subject of professional and scientific studies as well as a rich source of income to its owners. Due to the economic significance and geological complexity of the ore deposit, as well as for the purpose of ensuring its optimal exploitation, distinguished mining, geological and metallurgical experts visited the Idrija ore deposit as early as in the 18th and first half of the 19th centuries. From the second half of the 19th century up to the First World War, important geologists of the Vienna Geological Institute, among others Lipold, Kosmat, Kropač and Pilz, were active in Idrija. In the 1960’s and 1970’s, the Idrija geological school was formed (Mlakar, Čar, Placer, Čadež). The geologists who were members of the school explained the origin of the ore deposit and its extremely complex structure, geologically mapped in detail the entire Idrija area and its broader surroundings, and later also influenced investigations throughout Slovenia. The consequence of this was that the Idrija region was, from the geological aspect, one of the most investigated areas in Slovenia (Čar, 2010).

Carboniferous, Permian, Triassic, Cretaceous and Paleocene-Eocene rocks can be found in the Idrija region. Extensive tectonic movements began in Middle Anisian and lasted throughout the Middle Triassic period. The paleogeographic conditions were highly complicated in this period, during which the famous Idrija mercury ore deposit was formed. Owing to extensive and complex tectonic events, the calm carbonate sedimentation was interrupted in Upper Cretaceous. Typical flysch rocks were formed in the foreland basin.

In the Miocene Epoch, the pushing of the Adriatic microplate under the European plate first transformed the rocks of the Idrija region into a huge recumbent fold. Owing to further displacements, the fold was cut up into individual nappes and intermediate nappe horses, which moved in southwest direction along the thrust plates for as many as several ten kilometres. The final structure of Idrija’s terrain was formed by numerous strong normal and then right-lateral faults, which thoroughly complicated the geological conditions in the Idrija region (Mlakar, 1969; Čar, 2010).
2.1. GEOLOGICAL DESCRIPTION OF THE IDRIJA REGION

2.1.1. Stratigraphic data

Carboniferous

The oldest rocks in the Idrija region are more than 300 million year-old dark grey Paleozoic clastic rocks of Carboniferous age. There are alternating shales and mudstones containing tiny lenses of quartz sandstones, rarely conglomerates.

Permian

Lying discordantly upon Carboniferous beds are Middle Permian quartz sandstones and conglomerates with transitions into variegated shales and siltstones of the so called Val Gardena formation. The above-mentioned clastic rocks are followed by Upper Permian, dark-grey, bituminous, stratified dolomites and stratified grey or almost black limestones rich in fossils.

Triassic

The transition from the Paleozoic to the Mesozoic era in the Idrija region was gradual and continuous. Permian carbonate rocks pass into variegated, developed rocks of Lower Triassic Scythian age. The several hundred metre-thick succession of Scythian rocks begins with stratified grey micaceous dolomite with intercalations of dolomite-quartz sandstones and interbedded marl intercalations continuously passing into lithologically richly developed beds of variegated shale, siltstone and calcareous sandstone with lenses of oolitic limestone. The higher lying oolitic horizons pass into poorly stratified grey dolomites, and these into marls and marly limestones, which are the youngest Scythian rocks in the Idrija region.

The Lower Anisian stage saw the continuation of stable sedimentation and the formation of a characteristic light grey, poorly stratified or unstratified dolomite. In the beginning of Upper Anisian, approximately 243 million years ago, extensive displacements began to occur, with alternating sections of land and shallow waters. Erosion washed away several hundred metres of older layers on raised blocks, leaving even Carboniferous shales, the oldest rocks in the Idrija region, lying on the surface. Owing to the described tectonic movements, the Middle Triassic Ladinian rocks were highly variegated and were mostly deposited discordantly on older rocks, in the case of the Idrija ore deposit even directly on Carboniferous shales. Alongside the diverse and variegated conglomerates and sandstones, Ladinian rocks are developed as bi-tuminous shales, siltstones, marls and sandstones (upper Skonca horizon). Also frequent a various pyroclastic rocks with lenses of reef limestones and tuffs with rare diabase and keratophyre intercalations. Special sediments characteristic of tectonic fault troughs began to form in the tectonic fault troughs. Owing to the complex tectonic conditions, the thickness of Ladinian beds changes considerably – in some parts they are more than 600 m thick, while in others they were not deposited at all.

The Ladinian rocks are covered by white, grained, unstratified, Upper Triassic Carnian Cordevonian dolomite with intercalations of organogeneous limestone or black thin-layered limestone and grey dolomite. Several-hundred-metre-thick Julian-Tuvalian beds were deposited over the Cordevonian dolomite. They begin with transitional, stratified dolomite, which passes into dark grey limestone. This is followed by a lower clastic horizon comprised of variegated shales, siltstones with anthracite intercalations, variegated calcareous sandstones and conglomerates. These are covered by laminated and oolitic megalodontid limestone with frequent remains of megalodontid shells. The upper clastic horizon is, by its composition and rock structure, quite similar to the lower horizon. Calcareous sandstones with lenses of variegated calcareous conglomerate are the most frequent rock intercalations. Grey, green and burgundy dolomite marls with marly dolomite lenses.

The passage of clastic Carnian rocks into Upper Triassic Norian-Rhaetian stratified dolomite is gradual and continuous. The dolomite, which is usually designated as ‘main dolomite’, is a thinly to mediumly stratified, dark to light grey coloured rock with scarce remains of cellular limestone. Interbedded shale or marl intercalations are frequent in the lower part, while stromatolite and oncoid levels can be found higher in the column.

Jurassic

Owing to complex tertiary tectonic activity, Jurassic rocks are not preserved in the Idrija region.

Cretaceous

Due to thrust tectonics, the entire profile of Lower Cretaceous limestone in the Idrija region cannot be found. An approx. 300 m-thick carbonate horizon is comprised of dark grey bituminous limestones with scarce intercalations of dark grey, thin-layered, grained dolomite. In the surroundings of Idrija and on the Črni Vrh plateau, Lower Cretaceous Requienia limestone gradually passes into Upper Cretaceous, dark to light grey and white, unstratified, rudist limestone.

Paleocene–Eocene

Upper Cretaceous limestone is interrupted in its upper part by distinct erosional unconformity, above which Paleocene and Eocene flysch rocks began to be deposited approximately 65 million years ago. Alongside the typical greyish-green shales and marls, quartz sandstones can also be found. Lenses of calcareous sandstones and breccia appear in these rocks. Coarse-grained to block calcareous conglomerates can be found in rare spots along the base, and calcareous conglomerates higher in the profile. Flysch rocks are the youngest sedimentary rocks in the Idrija region, and can be found in Idrija’s tectonic windows.

Recent deposits

The slopes along the upper Idrija River and on Stopnik are covered with extensive boulder rockfall sections, as well as occasional small patches of lateral debris. Small riverside gravel terraces can only be observed in Bela, Idrija and in Spodnja Idrija.
1.2. Tectonics

Tectonic activity in the Idrija region can be divided into the following stages:

- Middle Triassic tectonics,
- Upper Cretaceous-Paleocene stratigraphic gap;
- folding and thrust tectonics;
- Miocene normal and post-Miocene strike-slip tectonics.

**Triassic tectonics**

Until the end of Lower Anisian, a stable sedimentation process took place in the Idrija region and elsewhere throughout Slovenia. The disintegration of the Slovenian carbonate platform in the beginning of Upper Anisian marked the beginning of a tectonically very active period lasting from Middle Anisian to Middle Carnian. This period is known as the Idrija Middle Triassic tectonic period. The period of Middle Triassic tectonics was characterised by normal tectonic activity. At that time the Idrija territory was cut by several groups of more or less strong normal faults.

Along the normal faults, individual blocks were strongly lowered, while others were only slightly lowered or raised into blocks of land during the general rising of terrain. Around 750 m of layers were eroded on some of the raised blocks (Čar, 1985, 1990). Anisian, Scythian, Permian and even Carboniferous rocks were removed by the depositing of various Ladinian rocks on various older rocks. The strongest and deepest faults built up the ore deposit. It was here that the Idrija Middle Triassic tectonic fault trough and the mercury ore deposit were formed. The vertical displacement component of faults was from 600 to 900 m (Čar, 1990).

Middle Triassic normal tectonic activity created the complicated palaeogeographic conditions that are also strongly reflected in the present-day geological structure of the territory. Today the Triassic structures run in the direction east-west.

**Upper Cretaceous-Paleocene stratigraphic gap**

Tectonic movements in Upper Cretaceous caused the disintegration of the Dinaric Carbonate Platform, and the formation of flysch rocks in the foreland basin. Features and weak faults of varying directions in Upper Cretaceous limestone can be observed from this period in Idrija’s tectonic windows. Extreme erosional unconformity can be found between these limestones and Eocene-Paleocene flysch rocks. (Čar, 2010).

**Folding and thrust tectonics**

According to existing data (Placer, 1999; Vrabec & Fodor, 2006), folding and thrusting occurred in the Idrija territory in Upper Eocene and continued in Lower and Middle Oligocene. First a huge recumbent fold was formed which, under subsequent pressures, was cut up by strong thrust plates. Thrusting moved in the direction north-east to south-west. A thrust structure typical of western Slovenia was formed. Lying in the deeper basement of the Idrija region are rocks of the Hrušica nappe, above which are first the Koševnik nappe horse, followed by the Čekovnik nappe horse and the inversely lying rocks of the Kanomlja nappe horse, all of which are covered by rocks of the Trnovo nappe.

The complex folding and extensive thrusting strongly ‘mixed up’ the rocks. Nowhere in the Idrija region can any section be found with a normal stratigraphic sequence of layers from Carboniferous to Eocene. Eocene-Paleocene flysch layers are exposed in deep valleys, while the highest ridges are in several places built of Scythian, Permian and even Carboniferous beds. Thrusting and subsequent erosion created a number of interesting tectonic phenomena: various tectonic windows and tectonic half-windows, as well as tectonic klippes and half-klippes. However, the structurally most important and geologically most interesting are the huge Idrija tectonic windows, such as the Strug single tectonic window in the Idrijca River valley, the Bevk single tectonic window in the valley of the Nikova stream, and the Bratuš and Kanomlja triple tectonic window. In particular triple tectonic windows are a rare phenomenon in the area of the Southern Alps, and therefore rightly attract considerable attention.

Lying in the base of both single tectonic windows are Upper Cretaceous rudist limestones that are confined on top by erosional unconformity, and overlain by Eocene Paleocene flysch rocks. These flysch rocks are covered by Lower Cretaceous and Upper Cretaceous limestones of the Koševnik nappe horse that had been torn from the Hrušica nappe in the basement. Lying above the Cretaceous limestones of both triple tectonic windows is Upper Triassic Norian-Rhaetian bedded dolomite of the
Čekovnik nappe horse, overlain by variegated Carboniferous, Permian, Scythian, Anisian, Ladinian and Carnian rocks of the Kanomlja nappe horse in overturned position. All of the above-mentioned thrust units finally cover the rocks of the Trnovo nappe in normal position (Mlakar, 1969; Placer, 1973; Čar, 2010).

### Miocene normal and post-Miocene strike-slip tectonics

Owing to extensive occurrences in the area of the present-day Pannonian basin and in the Carpathians, the tensile stresses that dominated the Slovenian territory in Middle Miocene ran in the direction north-east and south-west. This resulted in the formation of huge normal faults with strong subsidence of north-east blocks, including the two largest faults in the Idrija region: the **Idrija fault** and the **Zala fault**. Alongside these faults, the north-east blocks were lowered by approx. 450 m.

Due to the underthrusting of Istria (Adriatic microplate) to the north and north-west below Slovenia and western Croatia from late Miocene onward, the stress conditions in Slovenia changed intensively. Compressive forces became predominant in the direction north-south. Underthrust zones were formed along the karst boundary. Older normal faults with ‘Dinaric’ direction were reactivated as right-lateral faults. Numerous parallel Dinaric faults were also formed, which strongly complicated the geological conditions in Idrija (Čar, 2010).

#### Idrija fault

The strongest fault in the Idrija region and one of the largest faults in the Southern Alps is the famous **Idrija fault**. The fault originated in Carnian and runs in typical Dinaric direction, cutting across the entire territory of Slovenia all the way to the area of Velebit in Croatia. On Slovenian territory, the Idrija fault can be traced from the alpine meadow of Predolina (1655m) across the Učja River valley to Žaga, and then along the Soča River valley to Most na Soči, and from here along the Idrija River valley to Trebuša, along the Hotenja valley and across the Oblakov vrh pass, and then along the valley of the Kanomljica stream and across the hamlet of Kanomeljsko razpotje to Idrija. The fault leaves Idrija along the valley of the Ljubevščica stream and crosses Hotenjsko podolje, Planinsko polje and Cerkniško polje to Čabranka and the upper Kolpa River. Throughout its course, the fault is morphologically well-defined and appears on satellite photos as a distinct, straight line. The width of the narrow fault zone varies, and is only 5 to 10 m in some parts, reaching several 10 metres in other parts. The broader fault zone is even up to 2 km wide in some sections. The dislocation of rocks in the fault zone led to the formation of distinct valleys, saddles and levellings. Except for the Učja River valley, the 120 km-long route of the fault zone across Slovenia is not directly visible anywhere. It was, however, crossed several times in the Idrija mine. The displacement of the north-east block in a length of approx. 2500 m in the direction south-east along the Idrija fault has been proven (Mlakar, 1969; Placer, 1981, 1982).

#### Idrija ore deposit

The Idrija ore deposit is the second largest ore deposit in the world in terms of mercury concentration, being second only to Almadén in Spain (Mlakar, 1974). But the Idrija ore deposit is not only a ‘giant’ among mercury deposits.
deposits; it has gained international repute and professional significance primarily because of the conditions in which it was formed, its exceptionally rich and unusual ores, geochemical and mineralogical compositions, and the extraordinary transformations into its extremely complex present-day state. At first glance, its present structure gives the appearance of inexplicable and unsolvable geological ‘chaos’. For this reason, considerable attention has also been attracted by the investigative ‘exploits’ of geologists who reconstructed the origin and development of the ore deposit through its geological history. The first geological data on the Idrija ore deposit were collected in the mid 18th century. Investigations of the ore deposit in the ‘modern’ period have been in progress – with one interruption in the period of the Italian occupation – for as many as one hundred and thirty years, i.e. from approx. 1874 to 2004, when the last (so far!) scientific findings on the geochemical composition and circumstances surrounding the origin of Idrija’s mercury ores were discovered and recorded.

The events accompanying the formation of the Triassic structure of the ore deposit and various mercury ores, as well as the transformation of the former ore deposit structure into its present state, represent a geological particularity of international significance.

**Formation of the ore deposit**

The transformation of the Triassic structure of the ore deposit into its present state cannot be explained in simple terms owing to the extensive and complicated events linked to the transformation of the entire area of the Southern Alps, and of course Slovenian territory. Due to strong Tertiary tectonic activity, individual chunks of rock first began to fold, forming an extensive near-thrust fold. The part of the Earth’s crust containing the Idrija Middle Triassic tectonic fault trough and the mercury ore deposit was first concave in shape, and later transformed into a vertical fold. Folding resulted in fractures that caused parts of the ore deposit to move in southwesterly direction. The continuing pressures caused the structure of the ore deposit to gradually lean southward (rotation of ore deposit). The old fractures ceased to be active and new fractures were created, causing individual parts of the ore deposit to shift northward. The final transformation of the large recumbent fold containing the Idrija ore deposit in its upper limb resulted in the formation of folding lines, i.e. large and extensive, almost horizontal tectonic contacts alongside which the Idrija deposit was pushed some 35 km towards the southwest, where it has remained to this day. Another extensive system of faults was formed several million years ago, which included the regional Idrija and Zala faults. These two faults cut the already greatly transformed mercury ore deposit into individual blocks,
moving them forward first in vertical and then in horizontal direction to the southeast (Čar, 2010). The result of the above-described events is the unique, ‘chaotically’ formed present-day structure of the ore deposit.

**Cinnabar ores**

Idrija’s cinnabar ores were formed in two ways, which is unusual for mercury ore deposits. In the first method, ore-bearing solutions trickled across the faults and fractures through older rocks of the Idrija ore deposit – Carboniferous, Permian, Scythian and Anisian rocks. The hot waters dissolved the soluble minerals, primarily calcite (CaCO\(_3\)), leaving small holes of varying size in the rocks. With the gradually decreasing pressure and the cooling of thermal water from 218° do 160°C, mercury (Hg) and sulphur (S) from the ore-bearing solutions combined to form cinnabar (HgS) or a noncrystallised cinnabar gel. In this way the small holes in the rocks, open faults and fractures were gradually filled with cinnabar (HgS). If there was not enough sulphur present, native mercury was released (shales impregnated with mercury droplets). The ores formed in the described manner are called *epigenetic cinnabar ores*. These ores are customary and have been documented in other mercury ore deposits around the world. Unique and unknown to other Hg deposits are the so-called syngenetic ores, or *sedimentary cinnabar ores*. Their formation is linked to the outpouring of hydrothermal waters enriched with mercury and sulphur, or directly with the cinnabar gel, into the then existing marshes where various sedimentary rocks, known under the name of Skonca beds, were simultaneously formed (Mlakar, 1969). In this *second phase of hydrothermal activity*, enormous quantities of mercury and sulphur began to flow along the faults. Like the first time, rich epigenetic cinnabar ores were formed in older rocks. A good part of the cinnabar gels was discharged directly into the marshes, forming rich (up to 78% Hg) *sedimentary ores* (Mlakar and Drovenik, 1971). Due to the small inflow of sulphur, part of the Hg remained in its elemental form, creating ore-bearing deposits with native Hg primarily in the Carboniferous shales (shales impregnated with native mercury droplets), Skonca beds (Mlakar, 1969; Mlakar and Drovenik, 1971, Čar, 2010), and partly also in some other rocks.

The Idrija ore deposit lies directly below the town of Idrija and extends in the direction NW-SE. It is approximately 1500 m long, 300-600 m wide and 450 m deep. Approximately 700 km of shafts have been excavated on 15 levels, where 158 ore bodies were found, of which 141 contain cinnabar (14 ore bodies with mostly syngenetic mineralisation and 127 with epigenetic mineralisation). Native mercury is predominant in the remaining 17 ore bodies. The names given to these exceptionally rich Idrija cinnabar ores were chosen primarily on the basis of their colour, structure and mercury content, and less on the basis of their composition. The richest ores were named *jeklenka* (steel ore), *apekovka* (brick ore), *jetrenka* (liver ore), and *koralna ruda* (coral ore). Among the ores specific to the Idrija ore deposit are *karoli ore* or *karolijevka*, variations of *sedimentary ores*, and the so-called *shale ore* containing a high percentage of native mercury. Based on the percentage of mercury in ores, miners and metallurgists divided ores (for practical reasons) as follows: *jeklenka* (*high mercury content, very rich ore, rich ore, and poor ore or bâšperh.*

More than 28 minerals of the Idrija ore deposit contribute to the diversity of Idrija’s subterranean world, among which the most important are: *cinnabar (HgS)*, *metacinnabar (HgS)*, *epsomite (MgSO\(_4\)-\(7\)H\(_2\)O)* in the form of stalactites or fibres, a special and rare mineral – *idrialit (C\(_2\)H\(_4\)\(\phi\))*), a secondary mineral – *kaolinit* (in beds of up to 15 metres), and richly coloured *melanterite (FeSO\(_4\)-\(7\)H\(_2\)O)*.

### 2.2 GEOMORPHOLOGY

The main characteristic of the Idrija hills is a sharp morphological cut that was formed in the strong and wide fault zone of the Idrija fault. The second basic geomorphological characteristic of Idrija territory is the valley of the Idrijca River and its unusual course, which is primarily the result of lithology and in some parts also of tectonic activity.

The Idrija fault is one of the strongest faults in the region of the Southern Alps, which divides the Idrija hills into two morphologically extremely variegated geotectonic blocks. The main characteristics of the northeastern Krnice-Masore block is a long, on average approx. 1000 m-high ridge running in the direction NW-SE. It begins in Dolenja Trebuša, continues across Utre and Vrhovec...
(1079 m, including Lokvarski vrh), and ends on the small upland plain of Idrijske Krnice with the highest peak of Mt. Jelenk (1107 m). On the north side, numerous morphologically strong ravines are cut into the Krnice ridge. The most prominent among them are the valleys of the Otuška ravine and Sevnica. On the other side of the Idrija River valley lies the beautiful, friendly world of the Ledine plateau, formed during the occurrence of numerous Middle Triassic fractures in the direction east-west. These fractures continue in the direction of Spodnja Idrija. In their fault zones, the Spodnja Idrijca basin was formed by rapid and unusual meandering of the Idrijca River. The Ledine plateau divides the Osojnica stream from Vrsnik, and Žirovnica from the extensive Dolska–Zavraška plateau.

The geotectonic block of the Idrija hills (in a narrower sense) lying on the southwestern side of the Idrija fault zone has a different geomorphological character. The sharp ridge of Mačkove laze, which is confined on the south-west side by the wild and picturesque Gačnik gorge and its numerous waterfalls, broadens out at Stržnikar into the vast and diversified Vojsko plateau. The plateau-covered world begins on the northwest side with the exposed viewing peak of Hudournik (1148 m), and on the other side by the viewing peak of Kotlovski vrh (1168 m). On the northeast side, the Vojsko plateau descends almost precipitously for approx. 450 m into the fracture valley of the Kanomljica River.

The variegated world of the Upper Idrijca River and the Belca stream represent a special geomorphological unit. The territory of this unit is closed on the north-east side by the southern slopes of Razori, Vodonos and Čekovnik. The extensive, sunny slopes have been shaped along the relatively steeply falling layers of Middle Triassic Ladinian rocks, while to the southwest the world of the upper Idrijca River is confined by the northeaster edge of the Trnovo forest. The so-called ‘sunny shelf’ of Čekovnik between Blašk and Bela peak, as well as the small upland plains of Pšenk and Gladke skale, were formed along the folding line between the limestones of the Koševnik horse and the dolomites of the Čekovnik horse.

The southeast part of the Idrija hills is represented by the extensive, karstified Črni vrh plateau in the broader sense. The central levelling of Črni vrh plateau and Zadlog were formed along the nappe plane between the ‘main dolomite’ of the Čekovnik horse in the basement and the Norian-Rhaetian dolomite of the Trnovo nappe. The world of gable end valleys and karst depressions in Lome was formed on flysch rocks of the Hrušica nappe. The Črni vrh plateau descends across the Predgrizhe ridge into the Hotenjsko podolje near Godovič, which was formed in a highly disturbed and lowered block of rocks between the Idrija and Zala faults.

2.3 THE KARST

The richly developed and often somewhat specific karst phenomena in the Idrija region are the reflection of complex rock composition, as well as tectonic and morphological stratification, of the highly variegated Idrija region. In a broader sense, the karst territory in Idrija may be divided into the high karst and the solitary karst, which includes the other ‘nonkarst’ territory in the Idrija region (Čar, 2010).

The high karst comprises the area of Pevec, Idrijski Log, Zadlog, the central part of the Črni vrh plateau, Predgriz and Lom, as well as part of Hotenjsko podolje near Godovič. It continues southward and westward along the boundary of the Trnovo forest, Javornik and Hrušica. Owing to the geological conditions existing on the other side of the Idrija River valley, the high karst passes into shallow limestone karst at Zagrebenc, Gladke skale and the valley of the Nikova stream. From the geological aspect, the high karst and the shallower limestone karst are built of Lower and Upper Cretaceous limestones of the Koševnik horse and Upper Cretaceous rudist limestone of the Hrušica nappe, which comes to light in Bevk’s tectonic window and in the Strug tectonic...
window. Typical of the high karst are deeply karstified carbonate rocks, particularly limestones, with all the characteristics of classical karst. On the surface, numerous sinkholes can be found in various geological structures (Čar, 2001), whereas the underground karst is characterised by deep abysses, occasional subhorizontal short caves, as well as short sinking streams and swallow holes (covered karst) along the thrust edges. Special mention should be made of the 400 m-deep Habě shaft, the famous boiling spring of Diève jezero (Wild Lake), and the powerful Podroteja springs.

All the remaining parts of the Idrija territory where the high karst has not developed is formally classified as the »nonkarst« world, but certain individual or group karst phenomena found here are classified as solitary karst. This type of karst is usually developed in limestones and dolomites of varying age found in the middle of impermeable rocks (shales, calcareous sandstones, etc). The size and development of karst phenomena depend on geological conditions, i.e. the petrographic features of rocks, thickness of permeable rocks, tectonics, hydrological conditions, and climatic conditions. The solitary karst is more extensively developed on Krnice, the Ledina plateau, Vojsko plateau, and in Srednja Kanomlja.

### B3 LISTING AND DESCRIPTION OF GEOLOGICAL SITES WITHIN THE PROPOSED GEOPARK

The area of the Idrija Geopark has an extremely diverse geological structure as regards the various types of rocks and their age, numerous tectonic elements, fossil and mineral sites. In many cases the geologically significant locations overlap with others, most frequently with geomorphological or hydrological natural phenomena (karst caves, gorges, springs, ...). The geodiversity of the area and its rich geological heritage is evident in the complex natural phenomena. There are 52 sites on the list of geological sites having the status of natural heritage, and are thus ensured special system protection in the Idrija Geopark (source: Nature Conservation Atlas), but not all of them are suitable for presentation. To this data base we have also added those geological sites that have no special legal protection, but are highly interesting and suitable for presentation to the public. From both of these lists and other extensive information, we have selected 41 sites that represent the most important geological and geomorphological heritage of the Geopark. Together with the viewpoints, there are 47 geosites that are suitable for presentation to the public. The final selection of these sites is listed in Table 1 with the following data: name, brief designation, nature protection status I, sort of natural heritage II, and use / purpose III. Abbreviations are specified for I, II and III.

### I. Nature protection status

1.a. Protected areas (P)

- landscape park (P-LP),
- natural monument (P-NM).

1.b. Natural heritage (NH),

- natural heritage of national importance (NH-nat),
- natural heritage of local importance (LH-loc).


### II. Sorts of natural phenomena

- geological (Geol),
- geomorphological (Geom),
- geomorphological underground (Geomu),
- hydrological (Hydr),
- ecosystem (Ecos),
- botanical (Bot),
- zoological (Zool),
- dendrological (Dend).

### III. Use / Purpose

- educational sites (Edu) – sites that we believe to be suitable for the interpretation of natural sciences on various levels, and are therefore appropriate for education trails for schools, field exercises for universities, etc.,
- scientific sites (Sci) – sites that are suitable for the interpretation of natural sciences on a scientific level, as well as for further scientific research and analyses,
- appropriate sites for the use of geotourism (Tour) – sites that are suitable for thematic trails for visitors of the Geopark, families, for relaxing in nature, etc.
- viewpoints (Vwp) – popular peaks offering panoramic views,
- historical (Hist) – in the vicinity of historical sites where visitors become acquainted with the unique history of the region,
- archeological (Arch) – sites related to archaeology.
### Table 2 – Geological sites

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<thead>
<tr>
<th>Name of site</th>
<th>Description</th>
<th>Nature protection status</th>
<th>Sort of natural phenomena</th>
<th>Use / purpose</th>
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<tbody>
<tr>
<td><strong>GEOSITES</strong></td>
<td></td>
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</tr>
<tr>
<td>1 IDRIJA ORE DEPOSIT</td>
<td>A complex geological phenomenon with mercury mineralisation, in which the main ore mineral is cinnabar. It is built of Carboniferous, Permian, Scythian, Anisian, Ladinian and Carnian rocks. A particularity of the Idrija ore deposit are the rich sedimentary ores and native mercury.</td>
<td>International P-LP (part), NH-nat</td>
<td>Geol</td>
<td>Edu, Sci, Tour, Hist</td>
</tr>
<tr>
<td>2 ANTHONY’S MAIN ROAD</td>
<td>Anthony’s Main Road is the oldest preserved part of the ore deposit that has remained accessible after shutdown of the mine. Preserved in this site are extraordinary geological phenomena such as Carboniferous rocks mineralised with mercury, Middle Triassic erosional unconformity, sedimentary and coral ores. The ore extraction methods used through history are presented.</td>
<td>International NH-nat</td>
<td>Geol</td>
<td>Tour, Edu, Sci, Hist</td>
</tr>
<tr>
<td>3 DIVJE JEZERO (Wild Lake)</td>
<td>Divje jezero (Wild Lake) is a complex geological, geomorphological and hydrological natural phenomenon, as it is simultaneously a cave, spring and lake. Alpine plants (Slovenian endemic <em>Primula carniolica</em>) thrive on its steep and cold slopes, and its cave is home to the only European cave vertebrate - the human fish (<em>Proteus anguinus</em>). Its international historical significance is linked to such famous scientists as Scopoli and Hacquet, broad-thinking researchers who worked as physicians in the Idrija Mercury Mine. It is arranged as a museum in nature.</td>
<td>International P-LP, P-NM, NH-nat, N2000</td>
<td>Hydr, Geomu, Geom, Geol, Bot, Zool</td>
<td>Tour, Edu, Sci,</td>
</tr>
<tr>
<td>4 IDRIJA FAULT</td>
<td>The Idrija fault is one of the largest faults in the Southern Alps, which cuts across the entire territory of Slovenia, continuing into Italy on the northeast side, and into Croatia on the southeast side. The events occurring along the Idrija fault are also connected to the Idrija ore deposit, which was cut off and displaced from the fault. Numerous earthquakes occurred in the broader fault zone. Remarkable views of the fault zone open up at Kanomeljsko Razpotje and Hudournik on the Vojsko plateau.</td>
<td>International NH-nat (part), N2000 (part)</td>
<td>Geol</td>
<td>Sci, Edu, Hist</td>
</tr>
<tr>
<td>5 ZALA FAULT, Podroteja</td>
<td>A distinctive and morphologically prominent fault zone which separates a variety of rocks. The fault zone is directly visible at several locations. It has an important role in forming the morphology of the terrain in the surroundings of Idrija.</td>
<td>P-LP (part)</td>
<td>Geol</td>
<td>Sci, Edu, Hist</td>
</tr>
<tr>
<td>6 BEVK TECTONIC WINDOW</td>
<td>Lying in the base of this single tectonic window are Upper Cretaceous rudist limestones, which are confined on top by erosional unconformity overlain by Eocene-Paleocene flysch rocks.</td>
<td>NH-nat</td>
<td>Geol</td>
<td>Sci, Edu, Tour,</td>
</tr>
<tr>
<td>7</td>
<td>STRUG SINGLE TECTONIC WINDOW</td>
<td>Exposed in the base of the window are Upper Cretaceous limestones and Paleocene-Eocene flysch rocks of the Hrušica nappe overlain by an overthrust plate of Lower and Upper Cretaceous limestone. This is a site of the Carniolan Primrose (<em>Primula carniolica</em>).</td>
<td>P-LP, NH-nat, N2000</td>
<td>Geol, Geom, Bot, Sci, Edu, Tour</td>
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<tr>
<td>8</td>
<td>KANOMLJA TRIPLE TECTONIC WINDOW</td>
<td>A triple tectonic window with three folding lines that structurally separate four overthrust units. A morphologically and tectonically complex phenomenon of regional importance, covering an area of 1.8 km².</td>
<td>NH-loc</td>
<td>Geol, Sci</td>
</tr>
<tr>
<td>9</td>
<td>BRATUŠ TRIPLE TECTONIC WINDOW</td>
<td>The Bratuš tectonic window reveals three overthrust packages of rocks lying one above the other. The deepest lying are the youngest Eocene flysch rocks, and the highest lying are an outcrop of the oldest Carboniferous shales.</td>
<td>NH-nat</td>
<td>Geol, Sci</td>
</tr>
<tr>
<td>10</td>
<td>KRAMARŠČA GORGE</td>
<td>An approx. 200 m-long gorge in the upper Idrija River valley with a very narrow entrance, partly impassable. Water has formed several waterfalls and pools in the gorge. The high walls are built of Upper Triassic, unstratified, grained dolomite. The area is cut by several faults running N-S. Site of the Bear’s Ear (<em>P. aurikula</em>), Carniolan Primrose (<em>P. carniolica</em>), and the Idrija Primrose (<em>P. x venusta</em>).</td>
<td>P-LP, P-NM, NH-nat, N2000</td>
<td>Geol, Geom, Hydr, Bot, Edu, Sci, Tour</td>
</tr>
<tr>
<td>11</td>
<td>BEDROVA GRAPA</td>
<td>A scenic gorge with waterfalls and rapids, also an exceptional geological locality. The entire profile of Upper Triassic Carnian beds and part of Norian-Rhaetian (main) dolomite are visible. The clastic rocks contain numerous sediment textures and remains of Carnian shells (<em>Myophoria</em> and <em>Pachicardia</em>). A site of endangered and protected plant species.</td>
<td>P-LP, P-NM, NH-nat, N2000</td>
<td>Geol, Hydr, Geom, Bot, Sci, Edu</td>
</tr>
<tr>
<td>13</td>
<td>CARNIAN SANDSTONES WITH FOSSILS IN GACNIK</td>
<td>Carnian sandstones pass in some spots into conglomerate with red jasper and intercalations of nodular limestone. The limestones contain the fossil remains of shells, ostracods, corals, spines of sea urchins, algae, and rare remains of land plants. Wetlands can be found below the barren sandy hills and ridges.</td>
<td>NH-loc, N2000</td>
<td>Geol, Geom, Sci, Edu, Tour</td>
</tr>
<tr>
<td>14</td>
<td>LADINIAN BEDS</td>
<td>Alteration of tuffaceous claystones and marlstones as well as nodular silicified limestones. Several well-preserved ammonites have been found here.</td>
<td>P-LP, NH-loc, N2000</td>
<td>Geol, Edu, Sci, Tour</td>
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<td>No.</td>
<td>Entry</td>
<td>Description</td>
<td>Location</td>
<td>Reference</td>
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<tr>
<td>15</td>
<td>DIABASE</td>
<td>Basalt outcrop with calcite almonds and basalt breccia (red and green coloured), which bear witness to volcanic activity 230 million years ago.</td>
<td>/</td>
<td>P-LP, N2000, Geol, Sci, Edu, Tour</td>
</tr>
<tr>
<td>16</td>
<td>VOLCANIC AND PYROCLASTIC ROCKS, Pisance</td>
<td>The surroundings of the Pisance farm are built of purple, red and grassy green tuffs and tuffites with intercalations of diabase and diabase breccia.</td>
<td>/</td>
<td>Geol, Edu, Sci, Tour</td>
</tr>
<tr>
<td>17</td>
<td>FOOTPRINTS OF UPPER TRIASSIC REPTILES, Medvedje Brdo</td>
<td>Fossil footprints of an unknown reptile. The footprints are on an almost horizontal, bedded surface of Upper Triassic Norian-Rhaetian 'main' dolomite. A sequence of five footprints is visible.</td>
<td>NH-nat</td>
<td>Geol, Sci, Edu, Tour</td>
</tr>
<tr>
<td>18</td>
<td>MEGALODON-TID SHELLS, Knipajz</td>
<td>Profile of Carnian beds (claystones and sandstones) from Julian-Tuvalian, an intermediate horizon between Julian and Tuvalian, with numerous remains of <em>Triadomegalodon idri-anus</em> megalitid shells.</td>
<td>P-LP, N2000</td>
<td>Geol, Edu, Sci, Tour</td>
</tr>
<tr>
<td>20</td>
<td>MORaine, Hudo polje</td>
<td>Distinct terminal moraine, 5 to 10 m high, believed to date from the peak of Würmian glaciation. In the terminal moraine is a large outcrop revealing the structure of the moraine hill. Fine gravel mixed with large blocks and fine mushy materials are predominant.</td>
<td>P-LP, NH-loc, N2000</td>
<td>Geom, Geol, Edu, Sci, Tour</td>
</tr>
<tr>
<td>21</td>
<td>TROHOVA RAVAN</td>
<td>An extensive, dry valley with periglacial debris, a typical alluvial doline. A botanical locality (<em>Gentiana Clusii, Lilium bulbiferum</em>).</td>
<td>NH-loc, N2000</td>
<td>Geom, Bot, Edu, Tour</td>
</tr>
<tr>
<td>22</td>
<td>UVAlA AND SOLITARY BOULDERS, Kočevše</td>
<td>Solitary boulders of Anisian dolomite in a karst depression sunken by several meters.</td>
<td>NH-loc, N2000</td>
<td>Geom, Edu, Sci, Tour</td>
</tr>
<tr>
<td>23</td>
<td>BABJI ZOB IN THE VALLEY OF THE BELCA STREAM</td>
<td>A solitary boulder in the form of a several meter-high dolomite column in the valley of the Belca stream.</td>
<td>P-LP, NH-loc, N2000</td>
<td>Geom, Edu, Tour</td>
</tr>
<tr>
<td>24</td>
<td>TOMAŽ'S TABLE</td>
<td>A huge &quot;rock table&quot; comprised of a thick rock plate situated on a narrow rock pillar. A product of tectonic activity and erosion.</td>
<td>NH-nat</td>
<td>Geom, Geol, Edu, Tour</td>
</tr>
</tbody>
</table>

**KARST AND HYDROLOGICAL PHENOMENA**

<table>
<thead>
<tr>
<th>No.</th>
<th>Entry</th>
<th>Description</th>
<th>Location</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>IDRIJCA RIVER VALLEY</td>
<td>The entire valley is a very narrow and in some parts barely accessible gorge with steep cliffs. Numerous interesting plant species thrive in the valley, including protected and endangered plants. Several historical and technical monuments are situated in the valley.</td>
<td>NH-nat, N2000</td>
<td>Geom, Hydr, Bot, Eko, Edu, Sci, Tour</td>
</tr>
<tr>
<td>26</td>
<td>SUHA IDRJICA</td>
<td>Represents the lower part of Črni potok, a torrential stream. By its bedding, this is a special type of water channel that was formed at the contact of dolomite and limestone. It runs beneath the fault in the Suha Idrijca gorge. Visible here is bedded dolomite (from Cordevolian upwards), which laterally alternates with limestone of Julian age containing Clypeina besici algae.</td>
<td>P-LP, P-NM, NH-nat, N2000</td>
<td>Geom</td>
</tr>
<tr>
<td>27</td>
<td>VALLEY OF THE BELCA STREAM</td>
<td>The valley of the Belca stream is a narrow water gap running in the direction of the Dinaric Alps. Very steep cliffs rise up from the bottom of the valley, in many places these are vertical, overhanging walls. Several botanical particularities can be found in the valley. This is home to the Soča trout. Several technical monuments are preserved in the valley.</td>
<td>P-LP, NH-nat, N2000</td>
<td>Hydr, Geom, Geol, Bot, Zool</td>
</tr>
<tr>
<td>28</td>
<td>GAČNIK</td>
<td>Gačnik stream, right tributary of the Trebušica, with waterfalls and profiles of Upper Triassic rocks and the fossil shells Myophora and Pachycardia, fossils of the bivalve mollusc Solenomorphora, and marsh meadows.</td>
<td>P-NM (part), NH-nat, N2000</td>
<td>Hydr, Geom, Geol, Bot</td>
</tr>
<tr>
<td>29</td>
<td>SPRINGS IN PODROTEJA</td>
<td>A karst spring lying near the confluence of the Idrijca and Zala rivers. Water is used to supply the town.</td>
<td>NH-loc, N2000</td>
<td>Hydr</td>
</tr>
<tr>
<td>30</td>
<td>DIVJI POTOK</td>
<td>On the left bank of the Idrijca River above the klavže (water barriers) is a strong tectonic spring, Divj potok. The spring rises at an altitude of 737 m from a fissure in the dolomite.</td>
<td>P-LP, NH-loc, N2000</td>
<td>Hydr</td>
</tr>
<tr>
<td>31</td>
<td>BUČKE</td>
<td>In the riverbed above Lajšt are natural water pools called bučke. These pools are formed in rocks with inclusions of softer materials that are easily carried away by water. The initial hole begins to broaden and deepen until several meter-deep hollows are formed.</td>
<td>P-LP, N2000</td>
<td>Geom</td>
</tr>
<tr>
<td>32</td>
<td>WATERFALL AT BIZJAK’S MILL</td>
<td>Waterfall at Črna, the left tributary of the Poljanska Sora near Podklanec.</td>
<td>NH-loc</td>
<td>Hydr, Geom</td>
</tr>
<tr>
<td>33</td>
<td>PONOR AND GORGE IN KLAME</td>
<td>A barely accessible gorge in Klame located within the Kanomljaca triple tectonic window. The Idrija fault runs nearby. During low water levels, the Kanomljaca stream disappears into a swallow hole.</td>
<td>P-NM, NH-nat</td>
<td>Geol, Geom, Hydr</td>
</tr>
<tr>
<td>34</td>
<td>ANŽIČKOVE AND PAGONOVE PONIKVE</td>
<td>A typical example of underground streams on dolomite, forming part of a complex geographic natural area, a rare ecosystem, habitat of endangered plant and animal species</td>
<td>NH-loc, N2000</td>
<td>Hydr, Geom</td>
</tr>
<tr>
<td>35</td>
<td>SPRING NEAR ŠINKOVČEVA ŽAGA</td>
<td>A strong karst spring connected to the nearby cave.</td>
<td>P-NM, NH-nat</td>
<td>Geomu</td>
</tr>
<tr>
<td>36</td>
<td>CAVE ABOVE KOBILA</td>
<td>A horizontal cave that is also a boiling stream; after rainfall a mighty waterfall roars and flows out from the cave, discharging into the Idrijca River.</td>
<td>P-NM, P-LP, NH-nat, N2000</td>
<td>Geomu, Sci, Edu, Tour</td>
</tr>
<tr>
<td>37</td>
<td>HABEČKOV BREZEN</td>
<td>The deepest natural shaft in the municipality of Idrija (400m), a true rarity because of its natural bridge at the entrance and the springs in the shaft. Water colouring has shown that waters from the shaft flow towards the springs at Podoroteja and Wild Lake.</td>
<td>P-NM, NH-nat, N2000</td>
<td>Geomu, Sci, Edu, Tour</td>
</tr>
<tr>
<td>38</td>
<td>SNEŽNA JAMA Below ŠTRANGEL</td>
<td>A step-like, inclined shaft. Occasionally used for visits.</td>
<td>NH-nat</td>
<td>Geomu, Sci, Edu, Tour</td>
</tr>
<tr>
<td>39</td>
<td>KALAR GLACIER</td>
<td>The cave is 45m deep, on the bottom of which is an open area where ice remains all year. The ice was exploited in the past.</td>
<td>NH-nat, N2000</td>
<td>Geomu, Sci, Edu, Tour</td>
</tr>
<tr>
<td>40</td>
<td>MATJAŽEVE KAMRE</td>
<td>Together with the Sora River, this labyrinth of caves represents a speleological site of regional importance. These are the remains of an active water cave carved by the Sora River. It is home to several rare and protected cave animals, and a paleolithic station.</td>
<td>NH-nat</td>
<td>Geom, Geomu, Edu, Sci, Tour, Arch</td>
</tr>
<tr>
<td>41</td>
<td>ZADLOG</td>
<td>Zadlog is a special karst polje formed entirely on dolomite. It is comprised of vast, wet meadows with typical vegetation and fauna.</td>
<td>NH-loc, N2000</td>
<td>Geom, Bot, Edu, Sci, Tour</td>
</tr>
</tbody>
</table>

**VIEWING POINTS**

| 42 | JAVORNIK | Javornik lies at an altitude of 1241 m and is the highest peak in the Idrija Geopark. On the higher parts of its southern slopes, fragments of dry grassland with mountain flora are preserved. Habitat of the wood grouse. Pirnat’s alpine hostel is situated below the peak. | NH-loc, N2000 | Geom, Bot, Zool, Edu, Tour, Vwp |
| 43 | HUDOURNIK | A viewing point along the edge of the Vojsko plateau. A site of endemic and protected plant species (*Primula carniolica* ..) | NH-loc | Bot, Geom, Ecos, Edu, Tour, Vwp |
| 44 | PRI GNEZDU (PR’ KOLU) | Viewing point of the Julian and Kamnik Alps and the Karavanke mountains. In the vicinity is a memorial plate dedicated to the wounded combatants and staff of the Pavla Partisan Hospital. | N2000 | /, Vwp, Edu, Tour, Hist |
| 45 | VODONOS | Viewing point of the entire valley of the Upper Idrijca River – Bedrova grapa, Kramaršca, and Mrzla rupa to the Črni vrh plateau, Javornik. | P-LP, N2000 | /, Vwp, Edu, Tour |
| 46 | HLEVIŠKA PLANINA MOUNTAIN PASTURE | View of Idrijski Log, Mt. Javornik and the Trnovo Forest and the valleys of the Idrijca River (Lajšt), Belca and Čekovnik streams. The northern slopes known as Slanice are covered with beech forests, occasionally mixed with sites of yew trees. A site of endemic and protected plant species (*Primula carniolica, Rhododendron hirsutum*). | NH-loc | Bot, Vwp, Edu, Tour |
Fig. BII - Map of protected areas, geosites, cultural heritage sites, nature sites and Natura 2000.
B4 DETAILS ON THE INTEREST OF THESE SITES IN TERMS OF THEIR INTERNATIONAL, NATIONAL, REGIONAL OR LOCAL VALUE

4.1 INTERNATIONALLY IMPORTANT GEOSITES

The area of the Idrija Geopark has four internationally important geological phenomena (adopted on ProGeo criteria): the Idrija ore deposit, the Idrija fault, Anthony’s Main Road and Divje jezero (Wild Lake).

Their importance stems from their regional dimensions, scientific, research, educational and historical value.

The Idrija Ore Deposit (1G) is internationally important and famous because of the complicated Middle Triassic tectonic activity that led to its formation, the exceptional diversity of its rocks, remarkably rich and unusual sedimentary ores, geochemical conditions and mineralogical composition, as well as the complicated transformation into the present-day state. The sedimentary cinnabar ores are a unique mineralogical-geological phenomenon in the world. They were formed during sedimentation in Ladinian marshland (Skonca beds) directly by the settlement of cinnabar gel (gel-like ore) or by the depositing of chalcedony particles saturated with cinnabar (sedimentary ore with sedimentary textures). The gel-like ores are naturally very rich, containing even up to 78% mercury. A particularity of the Idrija ore deposit is also the appearance of native mercury in economical quantities. The structure and formation of the ore deposit has attracted enormous attention from Slovenian and foreign geologists for more than 150 years. More than fifty papers on this topic have already been written. The Idrija ore deposit is the second largest ore deposit in the world by its quantity of mercury in one spot, being second only to the Spanish Almaden. Owing to its economic significance throughout its five-hundred-year history, the ore deposit is also of exceptional technical and historical importance.

Anthony’s Main Road (2G) is the oldest preserved part of the shafts of the Idrija Mine. After the mine’s shutdown, it remained open as a tourist mine. In a specially protected section, only the native mercury drops are visible, which is an exceptional rarity on an international scale.

Seven geological sections of international professional and scientific importance have been recorded in the area of Anthony’s Main Road. An exceptional geological phenomenon is the Middle Triassic erosional unconformity, which is visible at several locations. Between the Carboniferous rocks on one side and the Ladinian rocks on the other side (kaolinite rocks, dolomite conglomerate), some 750 metres of rocks of Permian, Scythian and Anisian age are missing. This is due to the erosion that occurred in Middle Triassic (Upper Anisian), when the rocks that had been forming for around 60 million years were removed. Other exceptional phenomena on an international scale are the Carboniferous and Ladinian pyroclastic rocks mineralised with native mercury, bedded ore in tuffites, and coral ore (brachiopod of the genus Discina), whose fossil shells and cores were replaced by cinnabar.

Wild Lake (3G) is a complex geological, geomorphological and hydrological natural phenomenon. Its exceptionality is its geological structure and structural conditions, the extensity of submerged pit shafts, and the morphological shape of the cauldron-like lake. During high waters it spews out as many as several ten cubic metres of water per second, creating a mighty and at the same time the shortest Slovenian river before flowing into the Idrijca River. Its total discharge area covers more than 70 km². During low waters and drought, it appears as a romantic miniature lake squeezed below a mighty limestone wall. Divers have so far investigated the sunken shafts in a length of 462 m and up to a depth of 160 m, and their explorations are continuing. Thriving on the steep and cold cliffs are alpine plants such as the Slovenian endemite, Carniolan Primrose (Primula carniolica), and the only European cave vertebrate, the human fish (Proteus anguinus), lives in the nearby cave. Wild Lake is the northernmost habitat of this important Dinaric endemite. The international historical importance of Wild Lake is linked to famous researchers, such as Joannes Antonius Scopoli (after whom the plant species Scopolia carnoli ca has been named) and Balthasar Hacquet (after whom the plant species Hacquetia epipactis has been named), known as open-minded researchers who worked as physicians at the Mercury Mine in Idrija.
The **Idrija fault (4G)** is an incredibly strong fault, one of the strongest in the Southern Alps. It runs from Croatia across the entire territory of Slovenia and continues into Italy. Its length on Slovenian territory is 120 kilometres. Given the fact that numerous geological and geomorphological phenomena are linked to its activity, it is of exceptional significance for science and research. The fault was formed in two phases. Initially, it was created as a normal fault and then reactivated as a right-lateral slip with a displacement of 2.5 kilometres. Its course across Slovenian territory is morphologically very distinct, and appears on satellite photos as a clear, straight line.

In Table 1 above, the importance of each site is designated in abbreviated form in the column **Nature protection status**.

- **sites of international importance (Int)** – exceptional sites of international importance representing a rarity on an international scale,
- **sites of national importance (Nat)** – sites of importance on the national level and protected by state acts,
- **sites of local importance (Loc)** – sites of importance on the local level and mostly protected by local acts.

**Locus typicus for minerals and fossils, some also named after Idrija**

The Idrija Mine is a type locality (**Locus typicus**) for the mineral **Idrialite** (chemical formula $C_{22}H_{14}$). It is most often described as a soft mineral wax accompanying mercury ore in the Idrija Mine. It is normally greenish-yellow to light brown in colour with bluish fluorescence. This yellow-green organic mineral mostly appears in irregular forms or as a coating on jetrenka (liver ore). It was first described in 1832, and has international and scientific significance.
Numerous fossils were scientifically described for the first time in the area of the Idrija Geopark, and also have their type locality (Locus typicus) here. These include two new types of ammonites whose species names are taken from Idrija, *Tirolites idrianus* Hauer (Upper Scythian) and *Trachyceras idrianum* Mojsisovics (Ladinium), and two new types of shells whose species names are taken from Idrija, *Posidonia idriana* Mojsisovics (Carnian) and *Triadomegalodon idrianus* Végh – Neubrandt (Carnian).

The Idrija Geopark is also the locus typicus of two new species of brachiopods, *Lingula lipoldi* Stur (Carnian) and the shell *Ostrea lipoldi* Bittner (Carnian). Mention should also be made of two species of Middle Triassic flora that were scientifically described for the first time, *Sagenopteris lipoldi* Stur (Ladinian) and *Chiropteris lipoldi* Stur (Ladinian). All fossil species are of importance for international scientific research.

The Lipolds are named after the first Slovenian geologists, Marko Vincenc Lipold (1816-1883), a longtime administrator of the Idrija Mine. On the basis of numerous fossil remains of fauna and flora selected by Stur (1872), he analysed the rocks in the surroundings of Idrija and the ore deposit.

The surroundings of Idrija are also known for many other fossils. Those found in Lower Triassic (Upper Scythian) beds include the ammonites *Tirolites carniolicus*, gastropods *Werfenella rectecostata*, and the very rare remains of brittle stars.

4.2 NATIONAL AND LOCAL IMPORTANT GEOSITES

National importance has been determined or recognised for the »geosites« that are rare, typical, or of importance for scientific research or education on the national level. Their importance and use/purpose are indicated in abbreviated form in column III (Use/purpose) of Table 1.

Among the most prominent geological particularities are:

**Tratnik landslides (13 G)** are some of the most picturesque geological features of the Idrija region. Appearing in this landslides are various Carnian clastic rocks, from conglomerates to claystones, including some very beautiful Jasper conglomerates. Numerous sedimentary textures of varying sizes can be observed in the clastites. In between them are stratified or nodular limestones with interbedded marl intercalations containing shell cores. Due to the vicinity of the overthrust, the beds have been transformed into numerous folds of varying size, so that multiple passing of beds from normal into inverse position can be observed. Barite concretions have also been found here.

**Skonca beds (1 G)** are a particularity of Idrija. They were formed in a Ladinian freshwater marshland where some extremely rich sedimentary cinnabar ores were simultaneously deposited. The Skonca beds are typically comprised of dark brown or black sandstones, siltstones, claystones, marlstones and occasionally conglomerates that are rich in bituminous substances. In addition, freshwater marly limestones and kaolinite rocks can also be found here. The beds are rich in plant fossils which so far have not been the subject of research.
**Footprints of Upper Triassic reptiles (20 G).** Five fossil footprints have been found in grey bedded dolomite of Norian age (Upper Triassic). They are approx. 12 centimetres in diameter and separated from one another at equal distances of 32 centimetres. The sequence of footprints indicates that a two-legged lizard had lived here 220 million years ago in the period of Upper Triassic. The tracks are unfortunately not well preserved, so that the animal cannot be precisely determined.

**Idrija tectonic windows (9G, 10G, 11G, ...)**, including the Strug single tectonic window in the Idrijca River valley, the Bevk single tectonic window in the valley of the Nikova stream, and the Bratuš and Kanomlja triple tectonic window. Particularly triple tectonic windows are a rare phenomenon in the Southern Alps, and thus rightly arouse considerable attention and have scientific and educational importance on the national level and in the broader area of the Southern Alps.

**Bedrova grapa (11 G),** a scenic gorge carved by a stream, features a geological profile of the entire lithological development from Cordevolian, Julian, Tuvalian, and the lower part of Norian-Rhaetian main dolomite. The lithologically variegated, steep slopes of this 1800 metre-long gorge are built of dolomite, limestone, conglomerates, marls, and a variety of other colourful clastites. These clastite rocks have numerous sedimentation textures that are relevant for the interpretation of the palaeoenvironment. Contributing to the geological diversity of the area are also numerous fossils, lumachelles of megalodontid and other leading and typical Carnian shells, in particular Myophoria and Pachicardia. Even older Ladinian pyroclastic and diabase rocks can be found in the lower part of the gorge, at the confluence of the Kramaršca and Idrijca rivers. Karst phenomena can be traced in carbonate sections, waterfalls and rapids are frequently found in the gorge, and the vicinity is an important site of protected plant species.