

# IUGS GEOSITES PROJECT PROGRESS - A FIRST ATTEMPT AT A COMMON FRAMEWORK LIST FOR SOUTH EASTERN EUROPEAN COUNTRIES

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**Abstract:** This contribution refers to the progress of the Geosites project in the South Eastern European Countries. The Geosites project is an International Union of Geological Sciences (IUGS) initiative for the inventory and compilation of the global Geosites list. The first common European product of a Geosites framework for Europe appeared in *Geologica Balcanica* special issue "Geological Heritage of Europe". South Eastern European Countries have contributed greatly in this common effort, and decisive steps for the progress of Geosites project have been achieved with the workshops organized in Athens in 2001 and in Ankara in 2002 by ProGEO-WG1, the working group of ProGEO for SE Europe. The methodology of the inventory, as well as the S. Eastern European countries action plan and a first attempt for a common Geosites framework as an appendix, follow in this paper.

The initiative for the systematic inventory of the most important sites was undertaken by the Global Geosites Working Group, set up by the International Union of Geological Sciences (IUGS) with the support of UNESCO, and active since 1996. This inventory focuses mainly on the needs of the geological sciences research and education; there can be no science and education without site conservation, as it is well known. The project aims to involve the whole geological community in geoconservation, as well as to support any national or international initiatives to protect geodiversity, a resource that is underestimated and completely unrenewable.

This ambitious project started in 1996 as a consequence of discussions at an international level, and it intended to identify geological sites to be included in global site database and to aid protection projects, including a small number of sites to be included in the World Heritage list of UNESCO (Wimbledon, 1996).

In Europe, most of the pilot work for the Geosites project has been carried out by ProGEO, supported by its regional working groups and its national representatives. ProGEO's (the European Association for Conservation of the Geological Heritage) members represent most of Europe's nations.

As a starting point for the project, a SE Europe regional workshop of ProGEO, sponsored by UNESCO, was held in

Sofia in 1995, where a strategy for standardisation of the processes of the inventory and the compilation of the global Geosites list was discussed. IUGS's President wrote to all National Committees in 1996 announcing the new initiative.

Some significant milestones with reference to the Geosites project can be enumerated since then. The first common European product of a Geosites framework for Europe appeared in *Geologica Balcanica* special issue "Geological Heritage of Europe", in 1998, after the Belogradchik, Bulgaria ProGEO conference and Geosite IUGS-UNESCO World Heritage workshop (Ishchenko et al, 1998).

The phases of the project described in Belogradchik paper and already stated in Roma during a ProGEO international meeting, are the following:

- 1) first devise a country framework
  - 2) open a discussion in the country, publish the first attempt of the framework
  - 3) more or less finalize your country framework
  - 4) start to select sites to represent your matured framework
  - 5) discuss frameworks with neighbouring countries, and correlate frameworks between countries
  - 6) finalize a common geosite list for all countries (in your regional working group)
- to represent the final regional framework, that is - final representation of geodiversity of the region

7) place final documentation (standard format) in central database of IUGS.

-During all these phases publish and consult with all, at as many stages as possible-

Specifically for South Eastern European Countries and after a long period with a sinister situation in the region, decisive steps for the progress of Geosites project have been achieved via workshops organized in Athens in 2001 and in Ankara in 2002 by the ProGEO-WG1 (the network of the ProGEO group for SE Europe) with the valuable assistance of IUGS Geosites WG chair. The creation of the first Working Group of ProGEO goes back to 1995 in Bulgaria, during the first sub regional meeting "Conservation of the Geological Heritage in South-Eastern Europe". Today ProGEO WG - 1 members represent: Albania, Bosnia and Herzegovina including Republic of Srpska, Bulgaria, Croatia, FYROM, Greece, Romania, Slovenia, Turkey, and Yugoslavia.

This paper constitutes an attempt of 5th phase of the project, while at the same time phases 1,2,3, and 4 continue regularly in each country of the region (Theodossiou-Drandaki, 2001 and Theodossiou-Drandaki et al, 2001). A South Eastern Geosites frameworks list is presented as an appendix to this paper. This list is the product of fruitful cooperation between numerous geoscientists who constitute the network of ProGEO-WG1. It is a dynamic product, which will develop gradually and systematically, with the involvement and cooperation of all the more specialists, becoming more complete, with a representivity equivalent to the geodiversity of the region. This cooperation has been achieved electronically and with regular meetings and workshops organized in several countries of the region in order to discuss and correlate frameworks with neighbours. During the workshop in Athens, September 2001, an ambitious action plan for the continuation, progress and achievement of SE Europe Geosites was discussed and agreed as following:

1) In the country

Each country will complete its frameworks ("contextual frameworks") list. So, revised versions of Belogradchik lists or new lists will be compiled. Each country coordinator to undertake description of each framework to the format given below.

2) Between countries - join, eliminate or confirm frameworks. Comparison of frameworks between countries will start as soon as possible, but be completed by May.

3) By end May-Mid June (Turkey meeting) a regional framework list will be compiled - to be discussed and finalised at the meeting.

4) Final framework to be presented as a joint WG 1 paper at Dublin conference in September.

5) Countries, country coordinators, must edit the country lists, organise consultation with experts and discuss shared frameworks with the WG members in the countries next door. We aim to combine shared frameworks, and to eliminate those, which are unnecessary. To aid discussion between countries, we agreed to prepare a sheet (format)

for each framework in the country list, as follows:

1) Geosite framework

2) Concise description, a paragraph to a page in length, to make it possible to precisely compare frameworks between the countries.

3) Value of framework - is it of country/ Balkan/ Europe/global significance?

4) Suggested occurrence of framework in adjacent countries

What is important is that with this action plan as a guide, most of the goals have been fulfilled and this joint WG1 paper was presented in Dublin. What remains to be fulfilled for the final framework list of South Eastern European countries, is the continuation of consultation with experts, the valuation of the framework so far partially completed, and the thorough comparison after precise description for each framework. These will be some of the issues of next ProGEO WG1 meeting in Romania next year.

On the basis of the geosites project progress shown in this paper, it is expected that in a medium term the next steps of the Geosites (phases 6 and 7 of accepted methodology) will be achieved and completed and that the richness of regional geosites will be represented in international lists. We look forward to this end.

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Framework	Location (established and suggested)
<b>Stratigraphic</b>	
<b>Phanerozoic</b>	
Holocene	In all the countries
Pleistocene (e.g. marine and continental terraces)	Gr, Tr, ...
Quaternary remnants of alpine glacial and interglacial sediments	In all the countries
Karst cave sediments, their fossils and stone-age tools	Bg, Gr, Si, Tr, Yu, ..
Sedimentary sequences of Mio-Pliocene continental grabens from the Aegean Extensional region	Bg, Gr, M, Tr, ....
Quaternary and Neogene – Pliocene marine and brackish basins and sequences (e.g. Eastern Para-Tethys sequences of the Fore-Carpathian, Euxinian, Pannonian Basins; continental Pliocene deposits, marine and continental molassic sediments, complete marine cycles-Tr; sedimentary sequences of the grabens from the Aegean extensional region; Full section of Miocene molasse (e.g. Morava, Korcha region, Al; Velenje Pliocene lignite sequence-Si; Ligniferous basins of Pleistocene, Pliocene, Miocene age ( e.g. Macedonia, Thrace, Peloponnese-Gr)	Al, Bg, Gr, Ro, Si, Tr, Yu
Sections in Pre-Adriatic Depression (e.g. Erzeni section, Tirana region-Al)	Al, ?Gr, ?M
Eocene sections with Fe-Ni and Ni-silicate deposits (e.g. Bitincka Erzeni section)	Al, ....
Upper Cretaceous sediments with fish fossils of the Dinaric platform	Si, ...
Mesozoic section of the Tethys and Peri-Tethys (e.g. Mali I Gjere classical section of carbonate siliceous Mesozoic rocks in Ionian zone-Al; Gr)	Al, Bg, Gr, Ro, Si, Tr, Yu
Permian to Oligocene stratigraphic sections, with rocks' inversion and "high pressure" fossils (e.g. Tallaia Mts., Crete)	Gr
Palaeozoic sections of Gondwana and Peri-Gondwana origin	Bg, Gr Tr, Ro, ..
Sedimentary and biological characteristics of time-boundaries (e.g. Pliocene/Pleistocene boundary, Miocene/Pliocene boundary-Gr; Cretaceous/Paleogene boundary, East Balkan and West Fore Balkan-Bg; Jurassic/Cretaceous boundary, West Fore-Balkan and West Balkan-Bg; Permian/Triassic at Slovats-Yu and NW Dinarides-Si; Devonian/Carboniferous boundary at Millivoyevtsi, Druzetich, Valievo-Si; Silurian/Devonian, Varniche-Si, etc.)	Al, Bg, Gr, Ro, Tr, Si, Yu, ...
Phanerozoic stratigraphic and sedimentological phenomena (sequence stratigraphy, unconformities, sedimentary sequences, lithology, intertidal and supratidal carbonate platform sedimentation, climatic cycles, cyclic sedimentation-climatic Milankovitch cycles, condensed sections, "ammonitico rosso", hard-grounds, beach-lagoon sites, storm deposits, rudist biostromes, reefs, neptunian dykes, manganese nodule horizons, Middle-Upper Cretaceous transgression, etc.)	In all the countries
Stratigraphic stratotype sections of Balkan and European values (e.g. Triassic, Zlatibor-Yu; Triassic, Paleogene-Tr; Jurassic-Cretaceous transition with the clay-layers and facies at Bolietin River, Dolni Milanovats-Yu; Tortonian Molasse-Al; etc)	Al, Tr, Yu, ...
<b>Proterozoic</b>	
Precambrian sequences (e.g. Precambrian Pohorje metamorphic Group-Si; Rhodopes-Bg; Gr; Tufanbeyli autochthon-Tr ; Vlasina Complex-Yu)	Bg, Gr, M, Si, Tr, Yu
<b>Archaean</b>	
Archean (??) sequences of Pre-Rhodopian Supergroup (Rhodopes-Bg;Gr)	Bg, Gr

<b>Palaeoenvironmental</b>	
Holocene glacial forms (e.g. Jezerca, Gashi and Korabi highlands-Al; Rila and Pirin Mountains-Bg; remnants of Alpine glacial forms-Si)	Al, Ba, Bg, Si, Yu
High mountain Holocene lakes with glacio-lacustrine sediments (e.g. Rhodope, Rila and Pirin Mountains-Bg; Montenegro-Yu; Sylbica and Jezerca lakes-Al; Socha Valley, Srpenica-Si)	Al, Bg, Gr, Si, Tr, Yu, ...
Loess bearing records of the last 450.000 years (with remnants of large Pleistocene mammals, Serbia, Voivoidina-Yu). Loess/paleosoils alternations (e.g. Pydna-N. Greece)	Bg, Gr, Ro, Si, Yu
Quaternary and Neogene paleosols	Gr, Tr
Quaternary lakes and terraces (along the Black Sea coast and the Danube River-Bg; Ro; along the Black Sea coast-Tr; Bg; Ro; along the Aegean Sea-Gr; Tr; along the Adriatic-Al; Gr)	Al, Bg, Gr, Ro, Tr, Yu
Calcretes for Pleistocene climate	Gr, Tr, ...
Sandstone concretions with peculiar shape and specific conditions (e.g. Upper Miocene, Lower Meotian, Southern Carpathians)	Ro
Messinian salt crisis, Neogene evaporate basins	Gr, Tr, Yu, ...
Bioherms (e.g. in the Paleogene Dikilitash Formation-Pobitite Kamuni Rock Columns-NE Bulgaria)	Bg, Si, Tr
Sequence stratigraphic phenomena of palustrine carbonates (e.g. Upper Cretaceous/Paleocene palustrine carbonates in NW Dinarides)	Si, ...
Palaeokarst and karstification processes (e.g. Benca, Bogazi and Noraj, M. Jurassic break in sedimentation with paleokarst into Liassic massive limestones-Al)	Al, Bg, Gr Tr, Si, Yu
Various marine deep-facies zones in tectonically displaced and imbricated sections (e.g. Jurassic with radiolarites in SW Bulgaria; Jurassic marine with radiolarites, deep-facies zones in aborted tectonic rift-Si)	Bg, Gr, Tr, Si, Yu
Diagenetic features in carbonate rocks (e.g. in Triassic of W. Bulgaria; W. Slovenia)	Bg, ?Ro, Si, ?Yu
Continental red beds of Permian (Bg; Si; Yu, Curraj Eperm-Albania, etc.) and Early Triassic age. Marine red beds of Late Triassic age (e.g. Bg, Yu)	Al, Bg, ?Ro, Si, Tr, Yu,
Reefs of different ages (e. g. Neogene Kalemegdan, L. Permian Petkovitsa Monastery-Yu; Devonian coral reefs-Stegovnik-Si; Oligocene fringing reefs of "Gornji grad" formation-Si; etc)	Bg, Gr, Ro, Si, Tr, Yu
Complex systems as palaeoenvironmental indicators-fluvial, shallow and deep water, etc. (e.g. L. Jurassic fluvio-deltaic palaeoenvironment-fossil soils, channel fills, crevasse splays, with terrestrial plant remains-ferns, horsetails, pteridosperms, ginkgoales, bennettitales and conifers remains with <i>in situ</i> spores and pollen and in growth positions (Ponor Quarry-Ro)	Bg, Gr, Ro, Tr, Yu, ...
Euxinic environments of Early Silurian	Tr, ...
Palaeo-ecosystems of continental organisms, marine organisms or mixed	Gr
<b>Palaeontological</b>	
Footprints, fossil leaves (e.g. Santorini island, Gr) in volcanic rocks	Gr, Tr
Quaternary mammal sites (e.g. mammoth sites Nevlje-Si; Belgrade- Yu; Indigenous dwarf elephants in Tilos island, Crete island, Gr)	Gr, Ro, Si, Tr, Yu, ...
Fossilized palm-trees of Plio-Pleistocene age mixed with marine organisms ( e.g. SW Peloponnese)	Gr
Banks of Cirripedia of M. Pliocene age permitting the tracing of Pliocene coastline in Mediterranean sea.	Gr
Neogene mammalian sites (including large mammals, e.g. Axios (Vardar) basin with anthropoid <i>Uranopithecus macedoniensis</i> of U. Miocene age-Macedonia, Gr, Pikermi fauna-Attica, Gr, Samos island, Chios island-Gr)	Bg, Gr, Si, Tr, Yu
Neogene mollusc sites (e.g. Miocene-Central N. Bulgaria; reef at Kalemegdan, Belgrade, Karagach Valley, Grgeteg-Yu; Miocene bivalves in Pannonian basin-Si; etc)	Bg, Gr, ?Ro, RS, Si, Tr, Yu,
Upper Pontian (Pannonian G-E) very rich plant association-cineritic beds very rich in leaf impressions, today explored in eight fossiliferous outcrops (Chiuzbaia, N. Romania)	Ro
Petrified forests of various ages (e.g. Miocene-Lesvos island, Gr; Paleogene-Rhodopes, Bg)	Bg, Gr, M, Tr, Yu
Lower Miocene (Burdigalian)-sand bed surfaces with various fossil traces and trails (e.g. Southern part of East Carpathians, Priseaca Valea Sarii)	Ro
Fish and leaf fossils in marsh deposits of Late Miocene	Tr

Lower Oligocene (Rupelian) typical near-shore neritic fossil assemblage (e. g. Southern Carpathians, Suslanesti)	Ro
Oligocene-rich benthic fish association, (e.g. East Carpathians, Pietricica, Cozia Cernegura)	Ro
Paleogene large foraminifera in bioherms (e.g. Eocene Dikilitash Formation-Pobitite Kamuni Rock Columns, East Bulgaria, East Moesian Plate, and East Fore-Balkan; Nummulites & Alveolina assemblage of the Eocene in the North eastern Dinarides-Si)	Bg, Gr, Tr, Si
Late Mesozoic large foraminifera (e.g. Cenomanian in the East Balkan, RS; Lower Cretaceous (Aptian) in the West Fore-Balkan, Bg)	Bg, RS, ...
Mesozoic molluscs (e. g. ammonites and brachiopods of Stara Planina and the Fore Balkan-Bg; Kchira site of Triassic ammonites-Al; Jurassic ammonites, Peloponnese-Gr; corals-Si; etc.)	Al, Bg, Gr, M, Ro, Si, Tr, Yu
Limestone with stromatolites (e.g. Grabon-Leqet e Hotit, Al; Parnassos-Gr)	Al, Gr, ...
Continental deposits with dinosaur remains and nests (e. g. Upper Maastrichtian continental red beds, Hateg and Tustea, SW Romania)	Ro
Fossiliferous Permian sediments (e. g. Upper Permian limestone with brachiopods- "Zazar Formation", Middle Permian Neoschwagerina limestone and Lower Permian limestones with brachiopods of Dovzanova soteska-Si; Bulog Limestone with ammonites, Sirogojno-Yu)	Si, Yu, ...
Late Carboniferous trilobites, brachiopods, bivalves, crinoids etc. (e.g. S. Karavanke Mts.-Si)	Gr, Si, ...
Late Carboniferous plants (e.g. Svoje and Dobroudzha coal basins-Bg)	Bg, Ro, ...
Namurian goniatites and conodonts (e.g. Devonian/Carboniferous boundary, with nine conodont zones, Milivojevici, Druzetic, Valjevo)	Yu
Devonian fish fossils	Tr, ...
Silurian graptolite faunas (e.g. NW Bulgaria; Tr; Chios island-Gr)	Bg, Gr, Tr
Trace fossils of different environments and age (e.g. Pcinja basin-Yu)	Bg, Si, Yu, ...
<b><i>Igneous, metamorphic and sedimentary petrology textures and structures, events and provinces</i></b>	
Paleogene, Neogene extensional basins of the Southern Balkans	Bg, Gr, M, Tr, Yu
Olistostromes, turbidite sequences (e.g. of Late Cretaceous-Paleogene flysch-type basin East Balkan and E. Srednogorie Zones-Bg; E. Pontides-Tr; Paleogene basin of W. Slovenia; Devonian-Bg; Yu; RS; Jurassic-Cretaceous-Bg; Yu)	Bg, Gr, Si, RS, Tr, Yu
Flysch basins of different ages (Nish-Troyan, L. Jurassic-U. Cretaceous-Bg; Yu, L. Cretaceous-Bg; Ro; Tr; Yu, L. Devonian-Yu; Bg, Carboniferous- Belava-Yu, Paleogene-SW Slovenia)	Bg, Gr, Ro, Si, Tr, Yu
Permian eolian deposits (e.g. Central Fore Balkan, Bg)	Bg, Yu, ...
Hercynian molasse	Bg, Ro, Tr, Yu
Marine and continental deposits of Carboniferous age (e. g. Upper Carboniferous fossiliferous cyclic carbonate/clastic sediments of the Southern Karavanke Mts.-Si)	Bg, Gr, Tr, Si
Cambrian sedimentary sequences	Bg, Tr, Yu
Lower Palaeozoic succession of Northern Gondwana	Bg, Tr
Collision volcanism of Quaternary age	Gr, Tr, ...
Quaternary subduction-related volcanism ( Volcanic Arc of Southern Aegean Sea, e.g. Santorini island, Milos island, Nisyros island)	Gr
Transform-fault volcanism	Gr, Tr
Extension volcanism of Plio-Quaternary age	Gr, Tr
Basaltic rocks with polygonal columns (e.g. Upper Miocene, West Carpathians and East Carpathians-Ro);	Bg, Gr, Ro, Tr, ...
Intraplate Miocene basalts (e. g. from the Moesian Plate and S. Bulgaria)	Bg, M, Ro, Yu, ...
Paleogene-Miocene volcanic arcs (volcanoes and volcano-sedimentary sequences)	Bg, Gr, Si, Tr, Yu
Upper Cretaceous volcanic and intrusive sequences (e.g. Banat-Timok-Srednogorie-Pontides magmatic Belt )	Bg, Ro, Tr, Yu,
Pillow-lava complexes (e.g. U. Cretaceous Bulgarovo paleo volcano, spectacular outcrops of "Bulgarite" -unique petrographic variety, Eastern Srednogorie-Bg; Dinaridic Belt-Yu)	Al, Ba, Bg, Gr, M, Tr, Yu
Late Triassic rift volcanisms related to the opening of Neo-Tethys Ocean	Ba, Bg, Tr, Ro, Yu
Ladinian volcanism within aborted rifting	Si
Mud volcanoes	Bg, Ro, ...

Sheeted dykes (e.g. Kachinar-Münella-Domgjon, Al; NW Bulgaria)	Al, Bg, ...
Volcanic structures and landforms recent and ancient (basalt lakes, columnar basalts, maars, tuff rings, etc. - Tr; Ro)	Bg, Gr, M, Ro, Tr
Polymetamorphic rocks (e.g. Serbo-Macedonian, Rhodopes-Bg; Gr, Menderes Metamorphic Provinces-Tr; Picari-Al; Pohorje, Kobansko Mts-Si)	In all the countries
Sanidinite facies contact metamorphism	Tr
Amphibolite facies, Triassic with fossils (e. g. Sakar Mountain-Bg)	Bg, Gr
Greenschist facies Mesozoic rocks (e. g. Eastern Rhodopes-Bg; Gr)	Bg, Gr, Tr, Yu
Eclogite and blue-schist high-pressure metamorphism facies (e. g. Derveni-Al; Tr; Syros island, Sifnos island, Tinos island-Gr)	Al, Gr, Tr, M, Yu,
Extremely high pressure metamorphism (newly found micro diamonds in the Rhodopes of N. Greece)	Gr, ?Bg,
Rift deposits related to the opening of Neo-Tethys Ocean	Tr
Triassic high-pressure metamorphism of Palaeo-Tethys	Tr
Oceanic crust of the Palaeo-Tethys subduction zone	Ba, Tr, Yu
Core complex	Bg, Gr, M, Tr
Ophiolite sections of different ages (e.g. Gjegan, Kalimash, Runa-Al; Dinaridic Ophiolite Belt-Yu; Complete ophiolitic sequence of Late Proterozoic-Early Cambrian age NW Bulgaria; Yu; Tr, Mesozoic ophiolite sequences Pindos Mts, etc-Gr)	Al, Bg, Gr, M, Ro, RS, Tr, Yu
Precambrian (and Cambrian) ophiolites and island arcs	Bg, Tr, Yu
<b>Mineralogical</b>	
Smaragds in desilicified pegmatites (e. g. Rila Mountain-Bg)	Bg, ?Gr, ?M, ?Tr,
Occurrences of large twins (up to 10-15cm) of sanidine in Paleogene trachyandesite (e.g. Mesta Valley-Bg)	Bg, ?Gr
Boudings in marbles, containing scapolite, diopside, amphiboles, titanite, clinozoisite, phlogopite, graphite (Rhodopes-Bg)	Bg, Gr, ?M
Polymorphic modifications of Al <sub>2</sub> SiO <sub>3</sub> (sillimanite - kyanite - andalusite) from the Rhodopes	Bg, Gr, Tr, ?M,
Sulphides, Cu-arsenates & Cu-carbonates (e.g. Vratsa Ore district)	Bg
Precious stones and gem minerals	Bg, Gr, Tr, Yu, ...
Zeolite mineralization (+L. Cretaceous magmatism: E. Srednogorie -Bg; ?E. Pontides-Tr; +Pg volcanism, E. Rhodopes - Bg; Gr)	Ba, Bg, Gr, ?M, Tr
Base metal druses and pyrite crystals in Pg deposits (Rhodopes-Bg)	Bg, Gr
Skarn mineralization from the metasomatic zones developed at the expenses of marbles, pegmatites and intrusions (e.g. Kopaonik-Yu, with complete develop zone of metasomatic alteration; Rhodopes - Bg; Gr, Strandja Mountains-Bg; Tr, Appusení-Ro, Serifos island-Gr)	Bg, Gr, Ro, Tr, Yu, ...
Late Cretaceous tourmaline-bearing pegmatites (e.g. W. Srednogorie - Bg; Dravograd area with the brown magnesium tourmalines, dravite etc., - Si)	Bg, Si, ?Yu
Macrocrystalline gypsum mineralization (e. g. Qafa e Kochiut-Al)	Al, Gr, ?Ro
Typical paragenetic assoc. of PGE Fe-Ni-Cu-Cr (e.g. Bregu i Bibes)	Al
Fe-Cu-S and Fe-Cu-S-Zn-Pb-As-Au-Ba association (e.g. in Mirdita Cu deposits-Al)	Al, ?Bg, Gr, ?Yu
Gold-silver telluride minerals and associated sulphides (e.g. in Upper Neogene-Sacarimb mine in the West Carpathians)	Ro
Neogene evaporite mineral beds (e.g. trona, borates, celestite)	Gr, Tr
Type localities of minerals (e.g. Konyaite, bursaite, etc., Tr; Strashimirite, kostovite, Bg; Moissanite in Vardar Zone and Serb-Mac. masse-Yu; Wulfenite classical locality etc., secondary Pb-Zn mineralisation-Si; Baryte and septarian concretions in Miocene sediments, Shtrihovec-Si; Pseudobrookite in the Uroi neck, South Carpathians-Ro, Nagyagite, petzite, muthmannite, stuetzite, krenerite, krautite, etc in Sacarimb mine, West Carpathians-Ro; Laureonite, kamarizite etc, Laurium-Attica, glaucophane, Syros island-Gr)	Bg, Gr, Ro, Tr, Si, Yu, ...
Sepiolite formations in lacustrine basins	Tr
Thermal spring carbonates	Gr, Tr, ...
Direct laterization of spilite-ceratophyre basement (e.g. Triassic)	RS, ...
Altered rocks-minerals (contact-metasomatic, skarns, epithermal type, etc)	In all the countries

/Albania are in the UNESCO WH List; Divjaka-Karavasta marsh-Al; Tuz Gul-Turkey, etc )	
Quaternary marine coastal deposits (oids, beachrocks, terraces, sand bars) and erosional forms (e.g. uplifted paleo coast lines-Gr)	Al, Bg, Gr, Ro, Tr, Yu
Recent eolian sand dunes (Black Sea, Aegean Sea, Adriatic Sea)	Al, Bg, Gr, Ro, Tr, Yu
Holocene glacial landscape (e.g. Rila and Pirin Mountains (the last in the UNESCO WH List); Albanian Mountains: Lura, Jezerca-Valbona, Bjeshket e Nemuna; Duuboki Do Hole - Serbia; etc)	Al, Ba, Bg, Gr, ?M, Ro, Si, Yu
Glacial landforms and deposits	Al, Ba, Bg, Tr, Yu
Karst-superficial forms and caves (e. g. Classical karst-superficial forms and caves-Si; Ljubljanska karst river and its tributaries-Si; Durmitor Mountain and canyon of Tara, registered in the World Heritage list-Yu; Samaria gorge, Crete island-Gr, Karstic erosional forms (e.g. Katharos plateau and Nida plateau, Crete island-Gr, Paleorelief of various ages, Parnassos mountain, Elikonas mt, Mainalon mt, Meteora mt, Cyclades islands-Gr, recent karst-Gr)	In all the countries
Evaporite karst	Tr
Impressive landscape of erosional rock columns, formed in Paleogene sediments (e. g. Pobitite Kamuni Rock Columns (Dikili-tash), a multi valuable category-NE Bulgaria )	Bg, ...
Rock pinnacles and rock bridges in carbonates and marbles	in all the countries
Erosional forms and landscapes formed in clastic sediments (e.g. Melnik Pyramides, Neogene, SW Bg; Belogradchik Rocks in Lower Triassic red beds-Bg, Meteora, Oligocene, Northern Gr; Cappadocia, Paleogene, Tr)	Bg, Gr, M, Tr, ...
Erosional forms in clastic rocks, in volcanics, in intrusive rocks (e.g. spheroidal erosion forms of granite, Tinos island-Gr), in quarries	In all the countries
Canyons and valleys and their specific landscape	In all the countries
Peat bogs (e. g. Kopren, Stara Planina-Serbia)	Yu, ...
Landscapes (erosional, karst, volcanic e.g. domes and columnar jointing in Lesvos island, Milos island-Gr, tectonic e.g. hanging valley of Ha, Crete island-Gr, fluvial, aeolian, glacial, in salt massifs and diapirs with dissolution-deposition phenomena, etc.)	Bg, Gr, M, Ro, Tr, Yu
Geotopes resulting from catastrophic phenomena (eg. Phalassara uplifted harbour, Crete island-Gr, traces-ruptures of recent earthquakes in various greek areas)	Gr
<b>Hydrogeology-Hydrology features</b>	
Hydrological features and aquifer systems, springs, thermal springs, etc (e.g. Lesvos island-Gr)	In all the countries
<b>Astroblemes</b>	
Spherolites (e.g. Kopluku)	Al
<b>Continental or oceanic-scale geological features, relationships of tectonic plates and terrains</b>	
Ophiolites (Late Precambrian-E. Cambrian Ophiolites, West Stara Planina – Bg; ?T; Mesozoic (?) Eastern Rhodopes-Bg, Gr; Mesozoic-Al, Ba, Yu, M, Gr, Tr, RS)	Al, Ba, Bg, Gr, M, Ro, RS Tr, Yu
Suture zones and melanges of different ages (e.g. Llogara-Al; Ankara-Izmir-Tr ; Vardar zone )	Al, Bg, Gr, M, Tr, Yu
Tethys terranes	Bg, Gr, Ro, Si, Tr, Yu
Early Paleozoic Peri-Gondwana and Gondwana terranes	Bg, Gr, Tr, ...
<b>Submarine</b>	
Flooded river valleys and coast lines (Black Sea coast of Bg, Tr, Gr)	Bg, Gr, Tr
Submarine hot springs and sink holes ( Izola)	Si
Karstic submarine springs ( e.g. Northern Peloponese)	Gr
<b>Historic</b>	
Ancient mines: e.g. Ai Bounar, 4000-5000 B.C (Cu)-Bg, Rudna Glava, (Cu) -Serbia; Rubiku (Cu, Au)-Al; Laurium, Kassandra, etc (Au, Ag)-Gr; Brdo, Ljubija, Prijedor (Fe)-RS; Opaline deposits, Starevo culture, earlier Neolithic (6th millennium B. C.), Divlje Polje, Kragujevac-Serbia; Second largest world Hg mine, Idrija-Si; Sacarimb gold mine, etc	Al, Bg, Gr, Ro, RS, Tr, Yu

<b>Economic</b>	
Oligocene sediment-hosted Mn deposits, NE Bulgaria	Bg
Paleogene epithermal deposits (base metals-Au) (e.g. E. Rhodopes, Serbo-Macedonian massif)	Bg, Gr, M, Tr, Yu
Cu-porphyry, VHMS, vein and epithermal deposits (e. g. L. Cretaceous, Chelopech, Bg high sulfidation type, largest gold deposit in Europe; Bor, Maidanpek, Serbia; Gjegjani, Al; etc.; Upper Carboniferous polymetallic vein mineralization of Litija-Si; Banat-Timok-Srednogorie-Pontides, Tr)	Al, Bg, M, Ro, Tr, Yu
Strata-bound base-metal deposits (e.g. Vratsa-Izdremets Ore district-Bg; Upper Triassic Pb-Zn Mississippi Valley Type mineralisation of Mežica-Bleiberg Range-Si; Anisian early diagenetic Zn-Pb mineralization in Topla, N. Karavanke Mts.-Si)	Bg, Si, Yu, ...
Magmatic and sedimentary uranium deposits (e.g. Middle Permian "red beds" uranium and copper deposits-Si)	Bg, Ro, Si,...
Emery ores, Naxos island	Gr
Skarn mineralization of Palaeozoic, L. Cretaceous and Paleogene age (e. g. Trepcha in Kopaonik-Yu, Stara Planina (Pz), Srednogorie-Strandja (L. Cretaceous), Rhodopes-Bg, Tinos island-Gr)	Bg, Gr, M, Ro, Tr, Yu
Titanium-Magnetite deposits (e.g. Kashnjeti)	Al, ...
Chromite Deposits (e. g. Bulqiza unique folded deposit and Shkalla-Al)	Al, Gr, ?M, Tr
Middle Triassic Hg epigenetic and syngenetic mineralisation (Idrija)	Si
Asphalt deposits (e.g. Selenica deposits in Tortonian sandstones )	Al, ...
Massive phosphate deposit ±U (e.g. Gusmari-Al)	Al, Gr,
Fe-Ni and Ni-Silicate deposit (e.g. Bitincka-Al)	Al, Gr, M
Metamorphic and sedimentary bauxite (e.g. Triassic and Cretaceous-RS; Amorgos island-Gr)	?Al, Gr, RS, Tr, ?Yu
Non-metallic magmatic and hydrothermal deposits (e. g. native sulphur, fluorite, etc)	Al, Bg, Gr, Tr, ...
Evaporite gypsum-anhydrite deposits (e.g. U. Permian-L. Triassic- RS; Neogene-Bg; Gr; Ro; Tr)	Bg, Gr, Ro, RS, Tr, Yu
Evaporite salt deposits ( e.g. Dhrovjani and Kavaja-Al)	Al, Bg, Gr, Ro, Tr
Coal deposits (e. g. Velenje Pliocene sequences- Si; Yu)	Bg, Si, Tr, Yu
Devonian Mercury-Cu-Ba deposits (e. g. Otomalji)	RS, ...
Geothermal fields	Gr, Tr, ...
<b>Structural</b>	
Neotectonic features, active tectonics, extensional and recent relief-building, tectonic windows (North Anatolian Fault Zone-Tr; Idrija fault area -Si; Olympos tectonic window, Tinos island tectonic window-Gr, etc.)	Al, Ba, Bg, Gr, Si, Tr, Yu
Neogene extensional structures from the south Balkans and Turkey (Aegean Extensional Region)	Al, Bg, Gr, Tr
Paleogene extensional structures	?Al, Bg, M, Tr
Alpine Fold-Belt structures (Carpathians-Ro, Balkan Fold-Thrust Belt-Bg; Yu, Hellenides e.g. Vossakos and Aghios Pavlos folds, Crete island-Gr, Albanides, Dinarides-Al; RS; Gr; M; Si; Yu; Pontides, Taurides -Tr)	Al, Ba, Bg, Gr, M, Ro, RS, Tr, Yu
Thrusts series of Crete island	Gr
Triassic tectonics (e. g. Late Triassic-Old Cimmerian structures of W. Stara Planina-Bg; Triassic tectonic graben of Idrija and Middle Triassic aborted rift-Si)	Bg, Si, ?Yu
Permo-Triassic salt domes and tectonics (e.g. Mali I Bardhe dome-Al)	Al, Bg, ...
Upper Permian to Upper Cretaceous platform sedimentation	Ba, Si, Yu
Polyphase deformed metamorphic units (Rhodopes, Sakar and Strandja Mts., Menderes, Serbo-Macedonian Mass)	Bg, Gr, M, Ro, Si, Tr, Yu
Geophysical anomalies	Cr, Yu, ...
<b>Geomorphological features erosional and depositional processes, landforms and landscapes</b>	
Capes (Black Sea, Aegean Sea, Adriatic Sea)	Al, Bg, Gr, Ro, Tr, Yu
Modern marine coastal landforms (spits, bars, beaches, lagoons, deltas, capes)	In all the countries
Modern lakes, wetlands, rivers and rivers' mouths (e.g. the mouths of the rivers drained into the Black Sea-the Delta of the Danube is in the UNESCO WH List; Sreburna wetland-Bg and Ohrid Lake – FYROM)	In all the countries



Ancient marble quarries (e. g. Ancient marble quarry, Thassos island-Gr ; Roman marble quarry- Pohorje, Si)	Gr, Si, Tr
Old oil deposits (e.g. Kuchova-Al)	Al, ?Ro
Remains of gold placers washed in ancient times (e.g. Vitosha Mountain-Bg; Northern Greece)	Bg, Gr, Ro, RS, Y,
Ankara melange (the site where the term "melange" was first defined)	Gr, Tr
<b>Geo-history, Geo-archaeology, Geo-mythology</b>	
Sites related to History (eg uplifted roman harbour- Phalasarna, Crete island-Gr), Archaeology (e.g. Kokkinopilos geo-archaeological site, Western Greece, Corinth Canal-Diolkos site, various ancient mines, quarries-Gr, Tr), to Mythology (e.g. Lerni Springs-Gr, Idaion Cave, Crete island-Gr, Girl Tower-Tr)	Gr, Tr, ....
Sites related to archeological discoveries (e.g. Oldest gold objects in the world, 4000 - 5000 years B.C, Varna Necropolis- Bg)	Bg, Gr, ?Ro, ?Tr,