



Addressing pending and emerging issues related to geodiversity and geoheritage through the concept of “Hyper Geosite”: example of the Mont Granier (Chartreuse Massif, French Alps).

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The topic of the present EGU session is suitable to propose and present the concept of “Hyper Geosite”, which refers to geosites characterized by both:

- a large range of geoheritage values, concerning multiple both geoscientific and additional values (according to the current terminology after Reynard et al.);
- a (very) high level of assessment results for several of these values.

Located in the French Alps at the northeastern end of the Chartreuse Massif, the Mont Granier (1933 m a.s.l.) can be considered as an example for defining, illustrating and basing the concept of “Hyper Geosite”. This iconic alpine mountain presents multiple outstanding geoheritage values:

- Geoscientific values: tectonic (half perched syncline characteristic of the subalpine geodynamics); stratigraphic (900-m-high natural vertical geological cross section showing a major part of the lower Cretaceous - Berriasian to Barremian (Urgonian facies) - stratigraphic sequence of alternating marls and limestones); hydrogeological (peculiar karst system); geomorphological (3 km² karst plateau typical of the subalpine semi-denudated holokarst hosting a giant cave network; geomorphological landscape due to the huge and famous landslide of the north face occurred in 1248 and current associated collapses and debris flows); palaeontological (famous cave bear bones field of Balme à Collomb cave).
- Additional values: ecological (Mont Granier geology and geomorphology support a rich biodiversity due to different staged ecotopes (including a frozen scree and its abyssal vegetation), protected in a Nature Reserve; historical and cultural (human, religious, political and cultural consequences of the 1248 landslide; history of alpinism ...); aesthetical and landscape (source of inspiration throughout the ages for numerous painters, as well as for photographers producing posters and postcards...).

The Mont Granier is so a major french geosite registered in the national geoheritage inventory as three-star site.

Such “Hyper Geosites” allow indeed to meet transversally all the pending and emerging issues addressed by the present EGU session, recalled below and illustrated point by point through the example of Mont Granier:

- Looking for standards related to the concepts and methods for geodiversity and geoheritage: Mont Granier geodiversity and geoheritage inventory and assessment gave rise to a specific integrative method based on geomorphological mapping.
- Geosystem services considered as an unrecognized part of ecosystem services: Mont Granier geodiversity and geoheritage offer or support provisioning services as fresh water, cultural services (mostly recreational) through the presence of caves and cliffs, a scenic landscape corresponding to the current criteria of “the natural beauty”, and biotope for preserved wildlife... .
- Geodiversity and geoheritage facing global change and natural risk: Mont Granier is particularly concerned by this issue with its famous instability, still active and possibly linked to climate change.
- Heritage stones and geomaterials for smart and resilient cities: gravitational dynamics of Mont Granier provides renewable geomaterials.

According to its capacity to address systemically all these relevant issues, the concept of “Hyper Geosite” should be useful to manage and protect such complex and multidimensional geosites in the frame of the current socio-ecosystem challenges.