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21. Scientific challenges for geoheritage conservation and promotion in Switzerland

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21. Scientific challenges for geoheritage conservation and promotion in Switzerland

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TALKS:

- 21.1 Biot V., Caze B.: La valorisation du patrimoine paléontologique : la réalisation de la maison de site du gisement Lagerstätte de La Voulte.
- 21.2 Perret A., Martin S., Guyomard A., Kramar N., Marthaler M.: A simplified geological map of the Chablais Geopark
- 21.3 Perret A., Reynard E., Delannoy J.-J., Nugue N., Guyomard A.: Itinerant exhibition in the Chablais area. Association of “objective knowledge” and “interpretation method” to elaborate a geotourism product.
- 21.4 Regolini-Bissig G., Martin S., Reynard E., Kaiser Ch.: Promotion of geosciences through non-personal interpretation: the Lausanne Geoguide application

POSTERS:

- P 21.1 Buchmann M.: Geoheritage in the Moesano region – between nature protection and landscape enhancement
- P 21.2 Bussard J.: Protection and promotion of geomorphological heritage in the Gruyère – Pays-d’Enhaut Regional Nature Park. Assessment and perspectives
- P 21.3 Fanguin P.: Geoheritage promotion of Thonon-les-Bains (Fr) region by the development of a geotourism product
- P 21.4 Maret H.: Cartography of the geomorphological diversity in Derborence (Valais, Swiss Alps)
- P 21.5 Reynard E., †Berger J.-P., Constandache M., Dumas J., Felber M., Grangier L., Häuselmann P., Jeannin P.-Y., Martin S., Regolini G.: The revision of the Swiss Inventory of Geosites (2006-2012)

21.1

La valorisation du patrimoine paléontologique : la réalisation de la maison de site du gisement Lagerstätte de La Voulte.

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La paléontologie est une des disciplines scientifiques rattachée à la géologie. Si les dinosaures sont les « stars » du grand public, les fossiles ne se réduisent pas simplement à ce groupe de vertébrés aujourd'hui disparu. Ainsi, différents musées de paléontologie ou d'espaces exposition dédiés aux fossiles traitent des sciences de la terre et de la géologie. La valorisation du patrimoine géologique devient alors moteur du développement économique d'un territoire. L'initiative de la réserve naturelle géologique de Haute Provence, en est un exemple avec, à partir de 1994, l'aménagement et la valorisation de sites géologiques, la création de routes thématiques et de sentiers, l'édition d'ouvrages présentant le territoire et l'ouverture d'un musée permettant de remonter l'histoire de la terre sur 300 millions d'années.

Un projet est actuellement en cours de réalisation à La Voulte-sur-Rhône en Ardèche. Le territoire de la commune abrite un gisement fossilifère à conservation exceptionnelle appelé Lagerstätte de La Voulte situé sur le site de La Boissine. Les scientifiques dénombrent une cinquantaine de Lagerstätte dans le monde dont 6 en France. Celui de La Voulte-sur-Rhône constitue un patrimoine remarquable de part la qualité de préservation des parties molles de ces fossiles. Afin de préserver le périmètre où se situe le gisement fossilifère, le Conseil général de l'Ardèche a fait l'acquisition du site de La Boissine et l'a classé espace naturel sensible (ENS). La commune a signé un bail emphytéotique avec le département pour réaliser une maison de site et un espace d'exposition sur l'ENS.

Ce projet prend place dans un contexte local marqué par une activité industrielle importante dans les années 1970 avec la présence de Rhône-Poulenc textile. La crise du textile entrainera la fermeture de l'usine en 1981 impactant la vie économique locale. Aujourd'hui, le géotourisme est un des leviers à actionner pour assurer le passage vers un nouveau modèle économique.

Le Lagerstätte de La Voulte étant connu essentiellement des scientifiques, la commune de La Voulte-sur-Rhône a souhaité faire découvrir ce patrimoine au grand public. Si un musée privé de paléontologie fonctionna de 1989 à 2006, il dû fermer ses portes car les locaux devenaient vétuste et exiguë. Le projet actuellement conduit par la commune, en lien avec le conseil général de l'Ardèche et en partenariat avec le Museum national d'Histoire naturelle, est la réalisation d'une maison de site présentant les collections du gisement de La Voulte mais également d'autres Lagerstätten. Cette maison est construite directement sur le site de la Boissine de façon à se situer sur les lieux mêmes des découvertes et des fouilles. En ce sens, ce projet se distingue de nombreux autres musées de paléontologie de par cette proximité entre « musée » et « terrain ».

Les fouilles qui vont reprendre pourront également être valorisés à travers des animations et une sensibilisation auprès du grand public. Sur le même lieu touristique, les visiteurs pourront ainsi s'immerger dans l'histoire géologique et de la vie sur la terre.

Dans un contexte d'ouverture prochaine de l'espace de restitution de la grotte Chauvet et de la réouverture de la Cité de la Préhistoire en Sud Ardèche, mais également de réflexion de création d'un Géopark par le Parc naturel régional des monts d'Ardèche, le projet de maison de site, dont l'ouverture est prévue à l'été 2014, prend place dans une dynamique territoriale de valorisation du patrimoine culturelle et géologique.

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21.2

A simplified geological map of the Chablais Geopark

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The Chablais area is member of the European Geopark Network (EGN) since 2012. Among other geotourist products the elaboration of a simplified geological map has been initiated in 2013 by the Chablais Geopark. For this project, the geopark associate specialists in quaternary research, geology research, geological education and geotourism.

Only official BRGM maps now present the Chablais area. Four of them are needed to cover the perimeter of the geopark. These maps are relatively complex as they address to specialists. The staff of the Chablais Geopark wish to propose a map which integrate latest knowledge on the regional quaternary deposits and which could be used by non specialists, in particular the local guides. The map should also encourage the visit of less-known geosites by presenting sixteen of them. The elaboration of the map is based on the method developed by Martin and al. (2010), which propose, after a first analysis of context and the definition of communication objectives to take into account four aspects to build geotourism products : the site and objects; the message and content of the product; the media; and the audience (fig.1). In the case of the simplified geological map of the Chablais Geopark, we have to deal with predefined aspects: the media (a map) and the audience (principally guides with a basic training in geosciences). The main objectives are also fixed: (1) the geological map has to be adapted to the level of knowledge of guides; (2) geosites have to be accessible and understandable by the widest audience; (3) the map should also be usable by the guide to support direct interpretation (to the general public).

The sites (or objects) have been selected in order to represent the geodiversity of the Chablais: sites have to cover the various kind of rocks and sediments of the area, as shown on the simplified map. Concerning the message, all the content is organized upon the three-stage story of structural landscape (rock formation, folding, erosion) developed by Kramar (2003, 2005, 2012) and Marthaler and Kramar (2003). The legend of the map and structural schemes, as well as the presentation of the (geo)sites are based on this concept. For instance, the legend of the simplified map regroupes in only ten colors all the rocks of the Chablais pile of nappes.

With the use of these methods and concepts (Martin et al. and Kramar) we try to develop a geointerpretive product especially efficient to communicate scientific knowledge to the public.

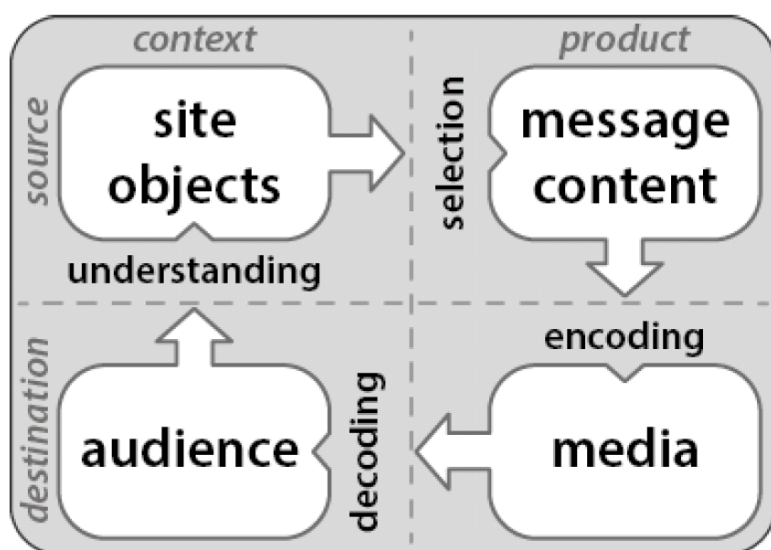


Figure 1. Four aspects to consider when elaborating non personal interpretation products.

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21.2

Itinerant exhibition in the Chablais area. Association of “objective knowledge” and “interpretation method” to elaborate a geotourism product.

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The Chablais area (French and Swiss Prealps) is considered as one of the cradles of glacial theory after the work of several researchers at the end of the 19th century (de Charpentier, 1841; Morlot, 1859). The association between glacial witnesses well preserved (moraines, erratics blocks, quaternary outcrops), the activity of scientists and a large use of glacial material by local populations in the area makes that the Chablais has an interesting potential to develop mediation tools based on glacial heritage.

Nevertheless, several problems must be solved before researchers and territory actors can be able to communicate on this “heritage” (glacial witnesses with high geocultural and scientific value and a strong link with quotidian life). First, the knowledge of glacial witnesses (deposits and landforms) is still incomplete and several questions remain unresolved, especially in zones where studies are rare or inexistent. Even to a larger scale, researchers do not agree, for example, on glacial retreat chronology. This situation requires a preliminary study in order to improve scientific knowledge of glacial deposits. In effect, it is difficult to communicate about obscure objects, in terms of age or formation (Gauchon 2010). To try to complete quaternary knowledge we undertook two kinds of studies: 1) geomorphological maps to establish a relative chronology and 2) cosmogenic dating to obtain ages.

The second problem is that glacial witnesses are relatively little-known by the population (Perret et al. 2010) even if these deposits and landforms are greatly used in building, tourism, leisure and strongly linked with resources as mineral water, for example.

Chablais actors' wish was to elaborate an itinerant exhibition to present glacial heritage. This work is a small part of an Interreg project (www.123chablais.com) dealing with the promotion of different types of natural and cultural heritage in the area. In order to elaborate an interpretative tool efficient to communicate the scientific knowledge to the public, we defined a specific audience for this exhibition: local population. The aim of the exhibition was not to propose a course on glaciers but to arouse awareness on Chablais glaciers and their witnesses. Then we defined a “scenario” in three steps: 1) glacial theory history 2) glacial retreat 3) link with daily life. A special work was to eliminate scientific vocabulary of texts and we used as often as possible pictures or sketches. A special care was made to illustrate maps and texts by local examples.

The exhibition is now shown since more than one year and we begin to collect impressions of the public. Several points can be improved: texts are too long, sites could be best situated (some people want to visit sites after the exhibition) and the conception of the three experiment posts is too fragile. The next step to finish the process of elaboration of a new geotourism product should be to analyse conceptions of public before and after visiting this exhibition, to control if visitors are better informed on glacial heritage.



Figure 1. Three thematic of the exhibition (1) glacial theory history 2) glacial retreat 3) link with daily life.

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21.4

Promotion of geosciences through non-personal interpretation: the Lausanne Geoguide application

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According to Dowling & Newsome (2006) geotourism products communicate geoscientific knowledge and ideas to the public. The objectives of geotourism – promotion and conservation of geosites and objects – request effective communication and education of the public. It is therefore essential to guarantee this efficiency in interpretive products, personal (e.g. guided tour) or non-personal (e.g. media-based).

The proposed global approach for the elaboration of non-personal interpretation products considers four fundamental aspects and their interplay: the site and objects; the message and content of the product; the media; the audience (Martin et al., 2010). Each of the aspects should be carefully analyzed before decision making about the products characteristics. This conceptual framework was applied i) to produce geotourism products like brochures, maps or trails and ii) to elaborate a method for the assessment of natural heritage trails (Regolini & Martin 2010).

The *Geoguide Lausanne* is an application for mobile platforms such as smartphones and tablets that aims at the communication of geosciences in an urban context (Reynard et al., 2014). In 30 stops evenly distributed in the city of Lausanne, interesting for its natural framework, the *Geoguide* focuses on research topics of the Faculty of Geosciences and Environment of the University of Lausanne. It was the Faculty's desire to communicate its findings in occasion of its 10th anniversary.

The application is an innovative interpretation tool addressed to local population and tourists interested to learn more about the urban landscape and its sometimes hidden mysteries (e.g. canalized watercourses or the origin of the steep streets of the town). The content focuses on the relationships existing between three spheres: A. the climate, water and atmosphere; B. the town and human activities; C. the substratum, rocks and landscape. Each stop focuses, therefore, on one specific relationship (e.g. alteration of the molassic rocks (relationship AC); urban development of a fluvial valley (BC); derivation of a watercourse for reducing rainwater volumes reaching wastewater treatment plants (AB), etc.

There are different possibilities to access the content: i) by tapping on the corresponding marker on the map where all stops are displayed, ii) by selecting a place of interest in a simple list, iii) by structuring the stops according to one of the three relationships mentioned above (fig. 1). Therefore, the application can be used as a fieldtrip guide following the proposed track, as a punctual interpretation device when visiting a given site or as thematic access to geosciences. Furthermore, the application offers two levels of complexity: a first level with short texts that attracts the users attention and raises its curiosity and pictures that not only illustrate the message (e.g. photo) but provide further explanation (e.g. maps or graphs) and a second level where more technical information and further reading is proposed (e.g. scientific papers in pdf format, etc.).

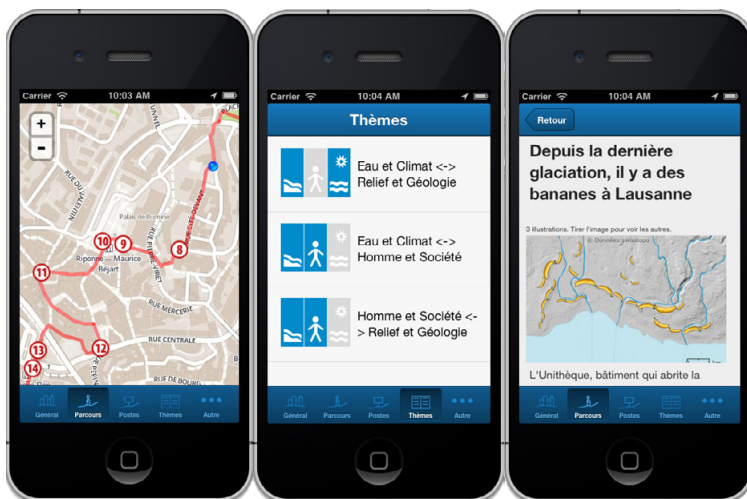


Figure 1. *Geoguide Application* with toolbar (below in blue) offering multiple entrance to the content and excerpt of the content of the stop 29 (<http://igd.unil.ch/geoguide/>).

As the application can be considered a trail when being used as fieldtrip guide, its quality was evaluated by the assessment method for heritage trails. The results give us an indication about the robustness of the model for non-personal interpretation to generate products that archive communication, educational and tourism objectives.

Acknowledgments

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P 21.1

Geoheritage in the Moesano region – between nature protection and landscape enhancement

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This work consists in the realisation of a geo(morpho)sites inventory (in a large sense of their definition) for the Moesano region (Mesolcina and Calanca valleys), which is situated in the south-eastern part of the Graubünden canton in Switzerland. It is partly situated in the perimeter of the National Park candidate – Parc'Adula, which presents both central and peripheral designed zones of the project.

An evolution of the assessment method developed by Reynard et al., 2007 will be applied. It will permit us to highlight and evaluate the characteristics of each selected geo(morpho)logical site, providing so a scientific basis for proposing a management strategy, including protection and/or enhancement measures.

The geoheritage approach is used by integrating it to an emergent kind of tourism called geotourism, which wants to promote geosciences to a broader public on a sustainable development basis. In fact the Moesano is a marginal and financially disadvantaged region, but it presents a great territorial richness on the cultural and the natural level, which if well promoted, can bring a certain regional development.

The ascertainment is that the abiotical part of the natural heritage is neglected compared to the biological and the cultural heritage as well as not well known by society as well as by the actors having an influence on the territorial development. One of the goals of the work is so to show the importance by taking it into account and to show the links that exist between the different nature and human spheres.

The reflexions of the work deal also with the apparent paradox between nature protection and landscape enhancement through tourism and/or educational promotion of a given site: how is it possible to promote geo(morpho)logical features which compose the landscape, without having a negative impact or pressure on the nature? What is the relation between nature protection and landscape promotion? Do we have first to protect nature before promoting landscape or is it possible to ensure nature protection by promoting the educational value of the landscape? In the case of the study area, we want to explore how it is possible to promote geo(morpho)sites inside the central zone of the National Park (if the project will be accepted). According to the new Suisse law this zone is in fact really restrictive. However, it is central that knowledge should be accessible to everybody if we want to promote a region in a sustainable way.

For responding to these questions it is necessary to document in detail each selected site and assess the more objectively as possible in order to show their overall characteristics. In a second step, protection measures are proposed for the sites which present high sensibility.

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P 21.2

Protection and promotion of geomorphological heritage in the Gruyère – Pays-d'Enhaut Regional Nature Park. Assessment and perspectives

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This Master thesis deals with two main issues: the protection of the abiotic nature and the promotion of geotourism in a protected area, the Gruyère – Pays-d'Enhaut Regional Nature Park in Switzerland. Regarding the protection of non-living nature (especially its geomorphological part), an identification and assessment of the geomorphological heritage is conducted, with special attention given to the degree of protection of the sites under the various laws existing at different administrative levels. The assessment is carried out using a method developed by the Institute of Geography and Sustainability of the University of Lausanne (Reynard et al., 2007), which aims to reduce the subjectivity of the evaluation using different defined criteria (such as the scientific value, additional values, etc.). Some modifications of the existing method and the addition of new criteria concerning the present use and management of the sites are proposed and tested by the author. Concerning the promotion of geotourism, we try to understand how Earth sciences, and especially geomorphological sites, are taken into account by the main stakeholders of tourism in the region. The final goal is to give some perspectives for a suitable protection and a better promotion of the geomorphosites according to the hypothesis that their promotion allows their social recognition as a heritage that has to be preserved.

The assessment method (see fig. 1) is separated in two distinct parts. First, the intrinsic value gives information about the scientific value (integrity, representativeness, rareness and paleogeographical value) and additional values (ecological, cultural and aesthetic value) of the geomorphosites. The scientific value is quantitatively assessed in order to classify the sites according to their scientific interest. Secondly, the present use and management of the sites are documented by different criteria related to the protection of the sites (sensibility, protection status) and their promotion. The visit conditions (accessibility, security and environment of the site, presence of tourism equipments), the educational value (readability of the site) and the economic value are criteria that inform about the possibilities to develop geotouristic activities.

33 sites are inventoried in the Gruyère – Pays-d'Enhaut Regional Nature Park area. Most of them (27 sites) are related to three main geomorphological processes: karst formations (karren fields, dolines, cavities and underground networks, etc.), relicts of glacial and periglacial processes (relict moraines or former rock glaciers) and fluvial landforms (terraces, waterfalls, canyons, etc.). The other sites are due to gravity processes (landslides, rockfalls), to organic processes (marshlands) and to structural processes (perched synclines).

The first results of the inventory show that the study area has a high diversity of landforms and presents a large set of geomorphosites with an important scientific value. The majority of the sites (but not all) have a good protection status. This protection is however more related to their ecological or landscape value than to their geomorphological characteristics. An improved knowledge of this geomorphological value and a better recognition by scientists and by the society are important in order to improve the protection of geomorphosites.

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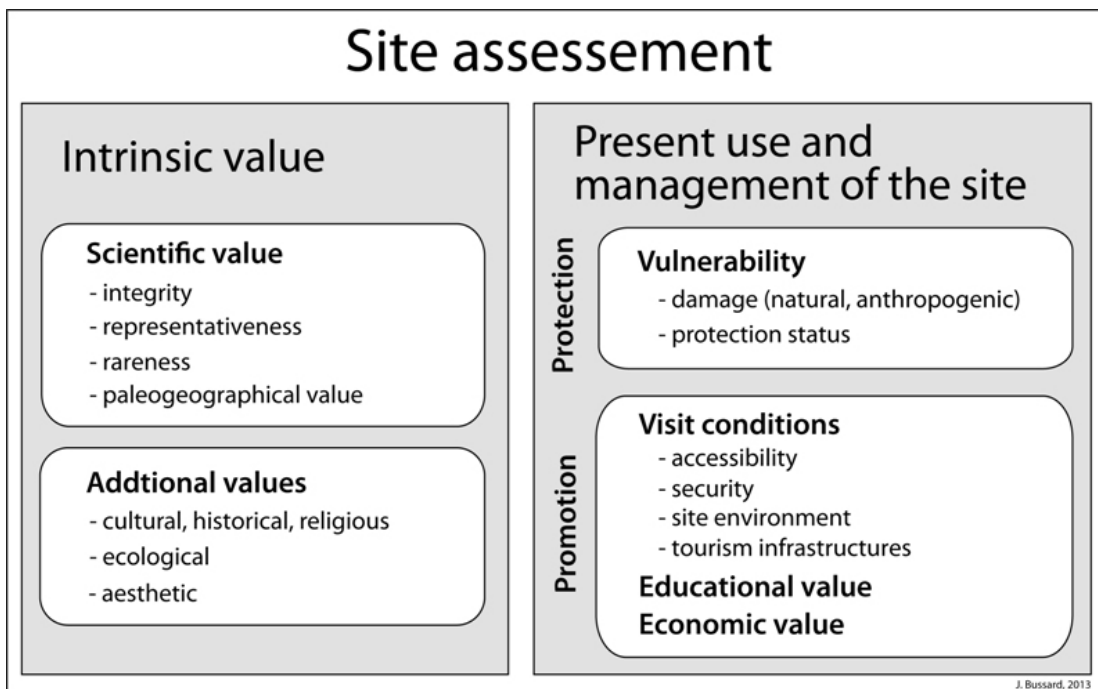


Figure 1. Summary of the assessment method.

P 21.3

Geoheritage promotion of Thonon-les-Bains (Fr) region by the development of a geotourism product

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Since 2012, the Chablais region (only in France) has acquired the Geopark label. This Geopark contributes to sustainable economic development of the region through geotourism. Moreover, the three Chablais (figure 1) are concerned by an Interreg IV program since 2009 (program of cooperation between European countries). The main objective of this program is to enhance the heritage resources (nature, culture and lifestyle of the region) (www.interreg-francesuisse.org). Therefore, the geotourism offer in this area just waiting to expand.

The geodidactics models like the simplification of the scientific content are essential for geoheritage promotion, because this content must be available to a wide audience, allowing thereby the geoheritage recognition. The geotourism permits to apply different models (Cayla et al. 2010, Sellier, 2009) through a wide range of geotourism products, like guide, educational panels, thematic hikes and recently developed, new medias (website, smartphone applications).

A geotourism product is based on four areas of questioning and was developed by Martin et al. (2010): (1) site (choice of sites to be valued), (2) public (a family public, good example of heterogeneous public), (3) contents (reasoning on geodidactics models) and (4) support (smartphone application). These four areas are very fundamental before the creation of any geotourism product. These reflexions aim to obtain a mediation product that integrates into geotourism offer of a region and contributes to its development and meets public expectations.

New media, such as digital media – smartphone, tablets, website – become geotourism products more and more attractive. In addition, the necessary technologies to develop new media help to integrate a high interactivity potential with the public and thus get their attention. The architecture of this geotourism product is based on the new application developed by the Institute of Geography and sustainability, and the Bureau Relief. One of the thematic itineraries is focused on the discovery of different natural resources by explaining their formation and their use by society, allowing to enhance a selection of geoheritage. The itinerary is entitled: In the footsteps of the exploitation of natural resources... a history of water and rock.

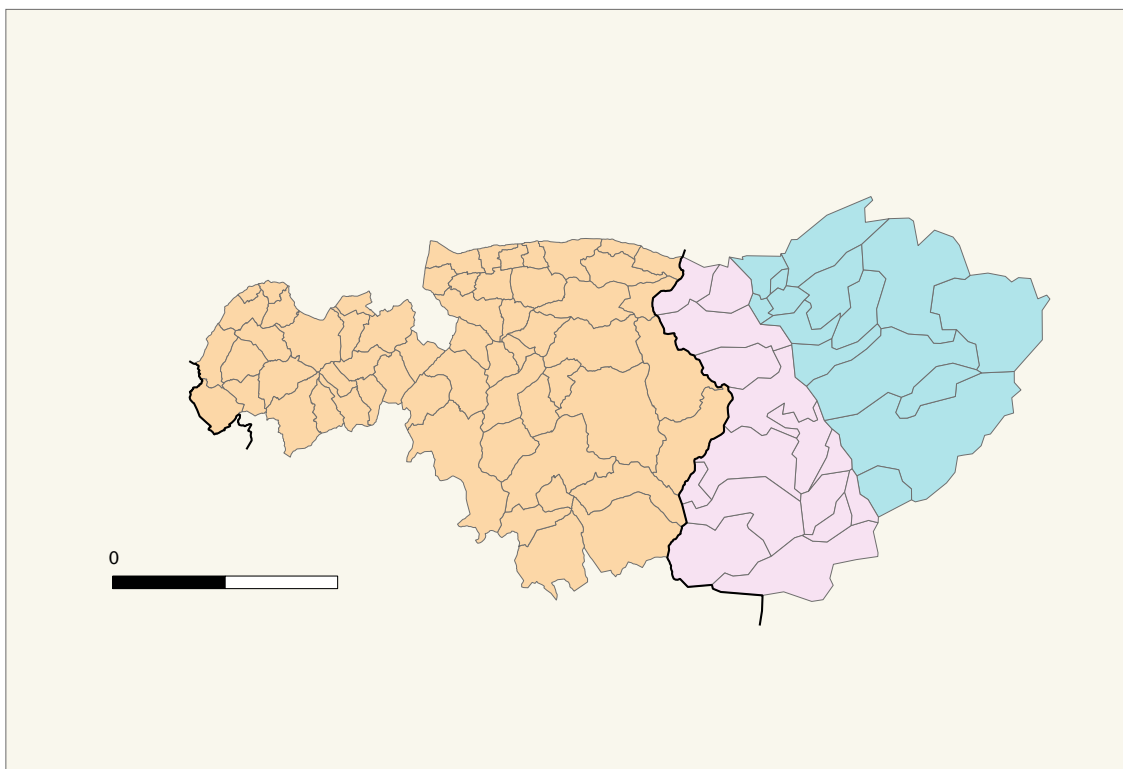


Figure 1. The limits of the three Chablais

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P 21.4

Cartography of the geomorphological diversity in Derborence (Valais, Swiss Alps)

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Valuing diversity of Earth features is a quite new topic in Switzerland. A lot of studies have been conducted about geomorphosites and geoconservation but the quantification of geodiversity has almost never been studied in Lausanne. “Geodiversity is the natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (landform, processes) and soils features. It includes their assemblages, relationships, properties, interpretations and systems.” (Gray, 2004: 6). In other words, “geodiversity refers to the heterogeneity of abiotic nature i.e. variability of earth surface materials, forms and processes at global, regional and local scales” (Hjort and Luoto, 2012). As geodiversity has a strong spatial component, cartography is a very good way to figure it.

This study tries to assess the geomorphological diversity from the basis of a geomorphological map. The diversity is not a value but an intrinsic characteristic of geomorphological features. It means that we do not consider geomorphosites in the cartographic process. The aim of this master thesis is to assess the geomorphological diversity by finding a methodology that permits to transform a geomorphological map into a map of the geomorphological diversity. The three stages of the study are: (1) to draw a geomorphological map of the area, (2) to find an index of the geomorphological diversity and, finally, (3) to draw a map of the geomorphological diversity and find a methodology for transforming the geomorphological map into a map of geomorphological diversity.

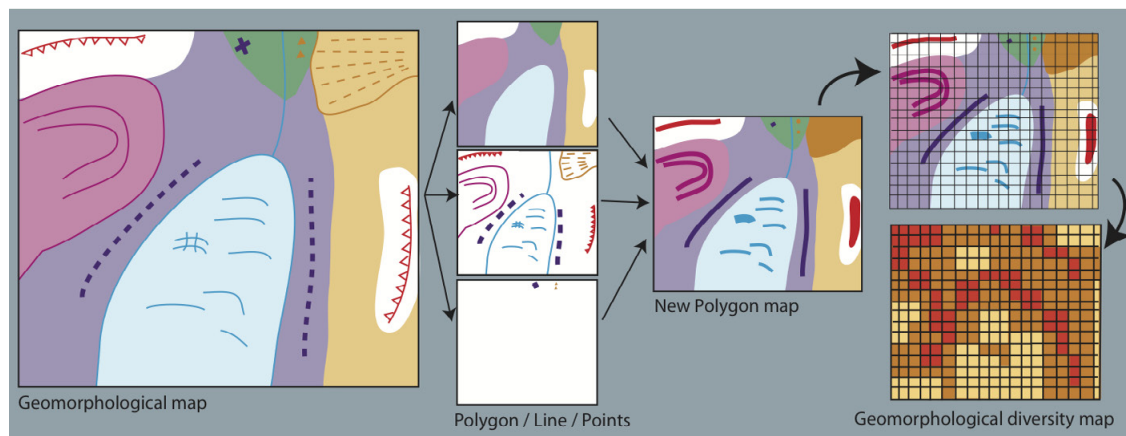


Figure 1. From a geomorphological map to the geomorphological diversity map

As represented in figure 1, geomorphological maps permit us to represent the main processes and the forms. This vector map is subdivided in three layers: points, lines and surfaces. The surfaces represent the processes: one colour per processes and no colour (white) for erosional processes. The lines and points can represent real forms (like moraines or rivers) or only be graphic (the direction of the debris fans for example). The next stage is to transform the three layers in one new polygon layer. Lines and points have to be transformed in polygons if they represent a form. New colors will appear: The debris fan in the upper right for example. From this new map, we will have to put a grid on it and calculate the geomorphological diversity index for each pixel.

Mapping geodiversity is a quite new topic in Switzerland. Although the diversity is meant here as the “intrinsic” diversity of geomorphological features without considering their value, this study could initiate a new value to consider when assessing geomorphosites. On the other hand, geodiversity assessment can also be very helpful for geoconservation.

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P 21.5

The revision of the Swiss Inventory of Geosites (2006-2012)

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Switzerland has a long history of geoconservation but it is only during the last two decades that a growing attention has been given to geoheritage protection and promotion (Reynard, 2012). In order to disseminate knowledge of Swiss geoheritage and to encourage the Swiss Confederation and the cantons to protect this heritage accordingly, the Swiss Academy of Sciences (SCNAT) created a working group on Geotopes in 1993. The working group undertook the compilation of a list of geosites of national importance. This work was not a real inventory, based on a common methodology, but rather a list of proposals made by experts from various parts of the country, various fields (palaeontology, mineralogy, geomorphology, etc.), and various institutions (cantonal administrations, nature historical museums, universities, etc.). More than 800 proposals were received from which the working group retained 401 geosites.

This list suffered several problems. One of them was its heterogeneity both in terms of content (regional discrepancy, differences between the various fields of Earth sciences) and of form (some proposals were very well documented in spite of others which were limited to the name of the site without any details of perimeter and description). Moreover, there was no information in digital form.

As a result, a revision of the inventory was carried out in 2006 by the working group, with the financial support of the SCNAT and the Federal Office for the Environment (FOEN). The revision was both formal and digital. A relational database was created and hosted on the SCNAT server. It allowed project contributors to introduce information in the system by completing a form from their office. In parallel, all the geographical information – especially the perimeters – was managed within a Geographical Information System (GIS) in order to simplify use by the public administrations. At the end of the project, the list was published on the mapviewer of the Swiss Confederation (<http://map.geo.admin.ch/>) and on the SCNAT website (<http://www.geosciences.scnat.ch>). Finally, a book, containing the list of Swiss geosites and a selection of the most emblematic sites, described in more detail, will be published in 2014.

In terms of content, the revision of the inventory needed a huge amount of homogenization work. A lot of data was added mainly because most of the geosites were poorly detailed in the 1999 inventory. Several sites were merged, others were abandoned because their national relevance was debatable. Moreover, a large survey was carried out to add new sites, especially for regions as well as fields of Earth sciences that were missing in the 1999 inventory. Also, some sites, which were not known in the 1990s, could be added. A good example is the Courtedoux geosite where numerous dinosaur tracks were discovered in 2000 during the construction of the A16 highway and that has gained international recognition today. The Glarner Hauptüberschiebung / Sardona Tektonic Arena, in the Cantons of Glarus, St. Gallen and Graubünden, is another good example. As a matter of fact, though the Glarus overthrust had already been recognized since the mid-19th century as one of the prominent examples of alpine tectonic history, it was curiously not proposed in the 1999 inventory. In the meantime, the site has been inscribed as a World Heritage Site by the UNESCO in 2008 and was added to the Swiss inventory of geosites.

An initial list of 248 geosites was published in 2008, while the final list (322 sites) was published in 2012 (Reynard et al., 2012). This inventory stimulated an interesting debate around the generic name that should be given to it. According to the FOEN, the terms “inventory” and “national importance” as used in 1999 (SCNAT,) – should be avoided today because such references could create a confusion with the official inventories carried out based on the Nature Protection Act. Finally, it was decided to call it the “Swiss Inventory of Geosites”. The next steps will be to distribute the inventory to Swiss cantonal administrations – in order to include its results in their land planning strategies – as well as to the managers of the new natural parks currently being created in Switzerland.

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