

# Mapping geoheritage for interpretive purpose: definition and interdisciplinary approach

Géraldine Regolini-Bissig  
Institute of Geography  
University of Lausanne  
Anthropole  
CH - 1015 Lausanne

E-Mail: [geraldine.regolini@unil.ch](mailto:geraldine.regolini@unil.ch)



## 1. Introduction

Since the raise of awareness of the importance of Earth Heritage (European Manifesto on Earth Heritage and Geodiversity, 2004), geomorphosites have obtained increasing attention from the scientific community. Assessment methods, classification and conservation strategies have been developed to safeguard the geomorphological heritage for present and future generations (Reynard et al., 2009). On the other hand, Earth Heritage creates opportunities to develop educational and recreational programs as well as tourism projects. Various interpretive supports and local development projects have been engendered in the past few years to promote the geoheritage.

The promotion of Earth Heritage holds the challenging task to reveal to a public of non-specialists (Carton et al., 2005) not only its beauty but, above all, its value as testimony of Earth History. Today's promotion is manifold and concerns different popularisation products and services such as thematic walks, brochures and educational panels, guided visits, etc. Maps are often employed as part of the cited products to show itineraries or points of interest. They also exist as independent media, through which it is possible to visualise geoscientific information. In this case, maps become interpretive media that serve popularisation purposes. However, the efficiency of a map depends on how good the map is designed and how good the knowledge transfer between the parties (scientists, public) operates (MacEachren, 1995).

This paper proposes two definitions of maps used in Earth Heritage promotion (geotourist maps and interpretive maps). It focuses then on the implementation of interpretive maps by pointing out the advantages of using an interdisciplinary approach to improve map effectiveness.

## 2. Definition

A map that is produced in the field of Earth Heritage promotion is commonly called geotourist map. "Geo" stands for the provenience of the information from Earth sciences (geography, geology or geomorphology) and "tourist" specifies both the recreational circumstances in which the map is consulted and the users. In spite of the amount of geotourist maps and increasing investigation on this topic (Carton et al., 2005; Castaldini et al., 2005a, 2005b; Bertacchini et al., 2008; Coratza & Regolini-Bissig, 2009; Bissig, 2008), no definition has been proposed so far. By identifying the shared characteristics of a large sample of maps one observes some similarities. They all address a public of non-specialists, communicate geoscientific information and integrate information about tourist facilities and services. Accordingly to this lowest common denominator a geotourist map can, therefore, be defined as *"a map that is used to communicate with a public of non-specialists and that visualises geoscientific information as well as tourist information"*.

In practice, the respective proportion of tourist and geoscientific information as well as the system used for representing such information (visual language, level of simplification of the information, background choice, etc.) are very different from one geotourist map to another (Coratza & Regolini-Bissig, 2009). The term “*geotourist map*” has, therefore, to be thought of as an umbrella term, in which different types of maps can be distinguished. A classification based on a statistical analysis of more than fifty geotourist maps (Bissig, 2008) differentiates between five groups with different levels of scientific content and tourist information:

- 1) Index maps: They contain low tourist information and low geoscientific information. Their principal goal is to localise itineraries or points of interest.
- 2) Tourist maps: In this type of map, major attention is given to the representation of tourist information such as picnic areas, car parks, accommodation, etc. Scientific information is, on the contrary, unsubstantial.
- 3&4) Geoscientific maps for amateurs of Earth sciences: The scientific content is high and the tourist component is medium. It is necessary to distinguish between two types of geoscientific maps for amateurs of Earth sciences because of their different representation system.
- 5) Interpretive maps: They present a good balance between scientific and tourist information. Furthermore, they try to interpret the represented landscape by revealing its particularities.

Because of the diversity of geotourist maps it is necessary to give a more precise definition of *interpretive maps*: they are clearly designed for the purpose of knowledge transfer between specialists and a public not or poorly familiar with geosciences. Used as an illustration instead of a simple orientation device, the map communicates spatially relevant information that helps to understand complex geoscientific phenomena. For instance, the map can picture past and present processes, which contributed to the formation and evolution of a given landscape. As the following definition clearly states, the essence of interpretive maps is to reveal meaning. Tourist information is not essential but may be added to provide the user with practical visit information.

*An interpretive map is used to communicate with a public of non-specialists. It focuses on the communication of geoscientific themes in order to provide the opportunity for the user to understand geomorphological or geological phenomena, formation or evolution. Tourist information is of secondary importance.*

*Definition of interpretive maps*

### 3. Challenges of mapmaking for interpretive purpose

#### 3.1 Information exchanges

The most important difference between interpretive maps and other geotourist maps is the way geoscientific information is presented to the public. The methodological approach, which leads to geotourist maps – especially geoscientific maps for amateurs of Earth sciences (Castaldini et al., 2005a, 2005b; Bertacchini et al., 2007) – is characterised by the principle of simplification. Starting with a geological or geomorphological map for specialists, the simplification is achieved through the reduction of the initial legend, and some specific figures being combined (e.g. active and relict landslides = landslides) or abandoned. In a second stage, basic tourist information (services and facilities) is added. In spite of the simplification process applied in the implementation phase, the derived maps are often rather complex. Furthermore, they are based on a mere reproduction of geoscientific facts from the specialists’ representation and legend system, that the public may have difficulty in understanding (Kruhl, 2006).

For the implementation of an interpretive map, the approach with regards to two key processing stages – defined by Coratza & Regolini-Bissig (2009) as codification and decodification phases – should be reconsidered (Fig. 1). In the first phase, the map-maker chooses the information that is to be communicated and designs the map. The modalities according to which the elements to be presented on an interpretive map are selected differ significantly from the ones followed in other geotourist maps implementation: it concentrates on the communication of specific themes and is directed to a well-defined target group (see example below). In the second phase, the users extract the codified information. For an interpretation to be effective, the bridgework (map) has to be correctly understood by the recipient (user). Communication and design issues are, therefore, the focus of interest.

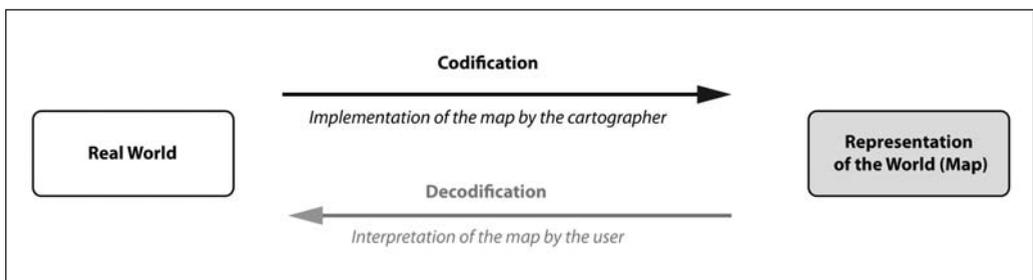


Fig. 1 Information exchange between cartographer and map user (Coratza & Regolini-Bissig, 2009).

### 3.2 Defining a new approach

The codification process determines what is going to be the content of the map. Rather than providing a simplified version of a map for specialists (see Carton et al., 2005), the proposed approach leads to the interpretation of the geoscientific reality of the mapped area. By interpretation we refer to the definition given by Tilden (1957) in the field of heritage interpretation: *“Heritage interpretation is an educational activity which aims to reveal meanings and relationships through the use of original objects, by firsthand experience, and by illustrative media, rather than simply to communicate factual information”*. Thus, the interpretive approach in mapping Earth Heritage means to assemble the information in order to communicate a specific meaning instead of pointing out the single geoscientific elements, as it is often the case in conventional geotourist maps. Providing explanations regarding the distribution or interaction of the various elements will lead to a higher understanding of landscape formation by the user.

Coratza & Regolini-Bissig (2009) proposed guidelines for Earth Heritage mapping that integrate a series of interpretation principles. They have been adapted (Table 1) to fit the specific field of mapping Earth Heritage for tourist purpose. Some of the principles are illustrated here by using the example of an exercise conducted during a mapping workshop in Switzerland.

Being confronted with the task of designing an interpretive map for the site of Derborence (Valais, Switzerland) (Regolini-Bissig et al., 2009), the participants (several geographers and geologists) first identified its main geomorphological features. This was made in order to choose one or a few *themes* that were going to be revealed with a map. In general, landscape interpretation can pick up nearly every topic as long as the field is appropriate. However, the principal theme is often suggested by the field itself. Secondary themes or less evident features should not be shown on the same map, but would be better placed in subsequent illustrations, as they would unnecessarily increase the visual load of the map and somehow hide the principle information. The creation of Lake Derborence offers an interesting story to tell. Its origin is due to large historical rockslides and the lake currently tends to be filled by alluvial sediments (Bekker, 1883; Mariétan, 1960). Other geomorphological features and processes not related to the formation of the lake were deliberately ignored thereafter.

Secondly, the participants identified the potential *users* of the map. Choosing a specific target group is important in order to adapt the content to their previous knowledge and conceptions of geoscientific processes (Megerle, 2008) and to their map reading skills (Kealy, 1998). As the visitors of the area are mainly composed of families that come to stay around the lake for a daytrip, it was decided to create a map for this target group.

Map components	Guiding questions	Guiding principles
User	Who is the intended audience?	Maps should not be designed the same way whether they are produced for amateurs of Earth sciences, seniors, families, teenagers or children. Different map user groups have different requirements and map reading skills. Choosing one of these groups or defining the intended audience by analysing the composition of visitors of a given site helps to focus the mapping efforts and to produce tangible maps.
Purpose	What is the purpose of the map?	Maps are produced and serve different purposes such as localising geosites and giving tourist information (index and geotourist maps), interpret geomorphological and geological features (interpretive maps) and providing simplified geological or geomorphological information (maps for amateurs of Earth sciences). Each application requires specific mapping principles in order to fulfil the specific needs.
Theme	What is going to be revealed with the map?	In order to limit the features to be shown on a map, only a small number of elements should be presented at one time. Especially for interpretive maps one should focus on one or two principal themes. Secondary themes are better left for subsequent illustrations. It is also recommended to portray information sequentially (series of maps) or operate with zooms, instead of overloading a document.
<b>The components above define the general framework of a map. They influence the decisions about the following elements, which have to be coherent with this framework.</b>		
Level	Wich complexity of information is desired / required?	The "Level" refers to the complexity of the data. It depends on both the purpose of the map and on the user. In any case do not burden the reader with unnecessary details.
Scale	Which level of detail for the representation of the surroundings and the geomorphosites is desired / required?	One element to consider is the ratio between the area to be covered and the size of the map. The visualisation of the surroundings (map background) and of the geomorphosites (point symbols, pictorial symbols, adapted geosciences mapping symbols) also influences the scale.
Dimensionality	How to show the morphology of the mapped area?	Whether to work with topographic backgrounds, digital terrain models, satellite imagery, air photographs or drawings depends on the purpose of the map and on the intended audience. It may be useful to produce several alternatives and test with the user which one works best.
Design	How to produce maps that look good and are easy to understand?	It is important to adapt the design to the defined target group and to follow cartographic conventions and basic graphic and map design rules. In order to furnish a well-designed map, it can be useful to entrust the final design of the document to a graphic designer.
Form and size	For what purpose and in which context is the map going to be used?	The choice of the map form (paper or digital maps, material and size of the paper map) is crucial as it will affect the production and up-date costs. It should also be considered that the map study ought to be as comfortable as possible in a given situation. For example, a large fold up map may not be the best option for a windy trail along the coast, as it would flap in the wind.
Costs	What are the costs involved in preparing and publishing the map?	How much of the budget can be employed to acquire data? To carry out field research or to process data? To eventually produce the map? The cost is an important aspect for every mapping project as it determines a series of the characteristics of the map such as mapping techniques (software, data processing) and print options (material, size, colour).

Table 1 Guiding principles for geotourism mapping (modified after Coratza & Regolini-Bissig, 2009).

The *purpose* of the map arose out of the principal theme and the intention to produce an interpretive map rather than an index or geotourist map. The idea was, therefore, to explain the creation of Lake Derborene. Consequently, the group created a map with the title "How was Lake Derborene formed?" (Regolini-Bissig et al., 2009). Stating clearly the purpose of a map with a title helps to communicate the intent of the map and to draw attention. The formulation as a question is generally more effective as a plain description of what is presented (e.g. Geotourist map of Lake Derborene).

The level of a map is defined according to several parameters. It depends on the purpose and the potential users of the map. It varies also if the map has to be self-explanatory or if it is accompanied by written information, a brochure, for example. Being confronted to a public with presumed basic geoscientific knowledge, the complexity of the data (*Level*) was kept as low as possible. It was further reduced by presenting the data on a series of maps. At the same time, the interpretive aspect could be enhanced as each map represents a step in the succession of the events that lead to the formation of the lake. There was no need for additional written information.

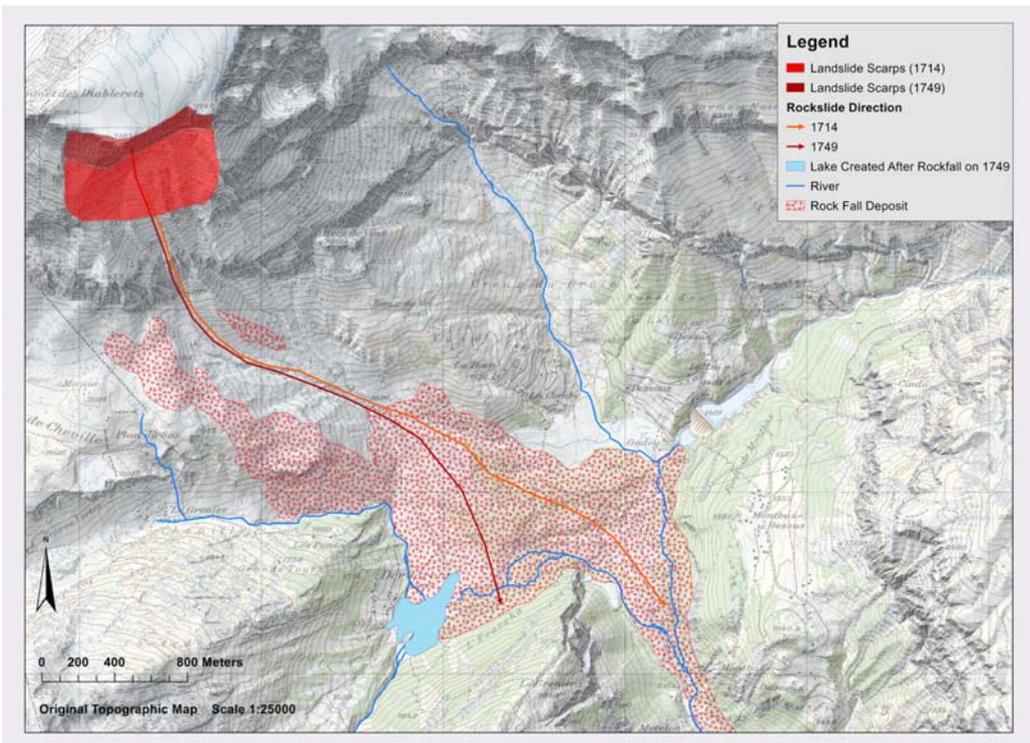


Fig. 2 First of a series of three maps explaining the formation of Lake Derborene. In this map two landslides and their deposits are represented (map designed by L. Ghiraldi and V. Garavaglia).

Having an approach based on interpretation principles determines what is to be shown on a map. The question of how it is to be represented leads to investigations concerning the communication process between the mapmaker and the public and design issues. Visual representation of geoscientific information (codification) must, therefore, fit the users' level of geoscientific knowledge and map reading skills (decoding). As seen above, geoscientists tend to represent data using the same representation and legend system used for communication among themselves. This may be misunderstood and can lead to misinterpretation of the data presented. Just as texts written with too many technical expressions, in a too small font or without relation to the readers' experience are unsuccessful from an interpretive point of view (Lehnes & Glawion, 2006), poorly designed maps will not keep the readers' attention and may be regarded as useless. Geoscientists involved in mapping projects should, therefore, have basic knowledge concerning visual information transmission and hold the necessary communication know-how with the chosen media.

Due to their prevalent training in natural sciences, geoscientists have often little experience in other branches such as human sciences. In many cases, map implementation could be enhanced using an interdisciplinary approach. Ideally, a project should be carried out in a collaborative effort (Patterson, n.d) by a team composed of scientists from different fields related to knowledge acquisition (psychologists), mapping issues (cartographers) and visual communication (graphic designers). As time and monetary resources are likely to be limited, a step up to an interdisciplinary approach could also be to incorporate major findings of related fields. Of course, this implies investing time but has the advantage of avoiding conceptual and fundamental design mistakes.

### 3.3 How to meet the mapping challenges?

It is not our ambition to give practical mapping advice in this paper, but to point out research fields that can help manage map codification and decoding. A short summary of different research fields and a few practical examples show their contribution for mapping enterprises.

#### *Heritage interpretation*

The already cited heritage interpretation deals with the mediation of scientific knowledge. Interpretation strategies and communication techniques were developed by different authors (Tilden, 1957; Ham, 1992; Beck & Cable, 1998) and were successfully applied in various settings of natural and cultural heritage interpretation: parks, zoos, museums, nature centres, and historical sites. In some countries (USA), *interpreters* are professionals that follow a specific training to acquire skills and knowledge allowing them to perform effective interpretation. In other cases, geointerpretation is often in the hands of scientists and needs yet to be professionalised (Kruhl, 2006; Megerle, 2008).

Different examples show that general interpretation principles can be blended with traditional cartographic principles (Bailey et al., 2007; Patterson, n.d.). But heritage interpretation also pays attention to maps as independent communication tools. Specific studies on how and in which context this medium best serves interpretation were carried out. One example is the case of *living maps* (Bremen et al., 1992). This giant canvas map, on which the visitors can place names, boundaries and symbolic projects, was developed to support the visualisation of large landscapes. Other studies focused on the topics of orientation and way finding. Interesting results concern, for example, the effectiveness of 2D versus 3D maps (Schoesberger, 2007).

#### *Cognitive sciences*

The cognitive sciences is another research field that studies the functionality of spatial and map knowledge acquisition. Including results about place recognition and way finding mechanisms as well as visual-cognitive processes of human-map interaction will help to design more accessible maps (MacEachren, 1995).

#### *Graphic design*

A very important point in map implementation is the design or how a map not properly designed “will be a cartographic failure” (Robinson, 1985). Before starting a project, it is, therefore, useful to get familiar with the elementary mapmaking principles. The presented guiding principles for geotourism mapping (Table 1) can help to ask essential design questions (user, level, dimensionality) that will affect many of the successive design choices. However, applying these principles cannot fully compensate expert mapping knowledge. It is, therefore, recommended to consult cartographic manuals (MacEachren, 1995; Slocum et al., 2009) and design handbooks. At the end of the mapping process, Martin & Reynard (2009) rightly propose to entrust the final design to a graphic designer. A professional, thus, that assembles together images according to visual communication principles in a way that is both accessible and aesthetic.

#### *Social investigations*

Even if in some cases the mapmaker can benefit from already acquired knowledge as described above, there may still be a need for investigations concerning the map users, either because the information is bound to the location or because generalised information is not available yet.

The determination of the target group is typical location-bound information. Currently, a lot of geotourist destinations do not dispose of statistical information about their visitors (Megerle, 2008). Often the most basic information such as gender, age profile, final educational attainment, work status, party size or level of geological studies are missing and mapping projects are carried out without defining

a clear target group beforehand. This and other questions concerning the visitor's motivation and focus of interest (Hose, 1996; Pralong, 2006), conceptions of geoscientific processes or landform recognition (Kramar & Pralong, 2005; Bissig & Kozlik, 2008) can be answered by means of empirical investigation methods provided by Social Sciences (Reynard & Berrebi, 2008). They need only to be adapted for our purposes. For a higher adequacy of the products that are to be proposed, standardised questionnaires can be distributed on the spot or surveys using scenarios and pictures can be conducted with different target groups.

## 4. Conclusion and perspectives

The amount of different geotourist map types and the manifold and individual way they are implemented show that geotourist mapping is a quite recent topic. In order to better apprehend map purpose and map creation, a general definition of the *geotourist map* as well as a classification of the different sub-types was given. The paper focused then on *interpretive maps*, which in our opinion have the greatest potential for knowledge transfer between geoscientists and the public.

The elementary guiding principles that lead to the implementation of this kind of maps were presented and illustrated by the means of an example (map of Lake Derborence). It was clearly pointed out that map production cannot deal exclusively with the codification phase, but must also include the phase of decodification. Importance was also given to design questions, which have to be considered in order to offer intelligible communication. Finally, an interdisciplinary approach inviting the integration of findings from related sciences was suggested to further improve map implementation.

For the future, it would be desirable to harmonise map implementation for the different map types on a national and respectively international level in order to facilitate information reception for the user. A shared mapping philosophy as proposed in this paper with the described approach for the implementation of interpretive maps is only the beginning. It needs to be discussed to find a large consensus before the next step – the development of a standardised map design – can be undertaken.

## References

- Bailey H., Smaldone D., Elmes G., Robert B. (2007). Geointerpretation: the interpretive potential of maps, *Journal of Interpretation Research*, 12(2), 46-59.
- Beck L., Cable T. (1998). *Interpretation for the 21<sup>st</sup> Century: Fifteen guiding principles for interpreting nature and culture*, Champaign IL, Sagamore Publishing.
- Bekker F. (1883). Bergsturz der Diablerets, *Ann. CAS*, 18, 310-316.
- Bertacchini M., Benito A., Castaldini, D. (2008). Carta geo-archeo-turistica del territorio di Otricoli (Terni, Umbria), *Proceedings of the 3<sup>rd</sup> National Conference of the Italian Association Geology and Tourism*, Bologna 1-3 March 2007, 213-220.
- Bremen G., Albrecht B., Dale M., Hertel E. (1992). The living map: Bridging the gap, 1992 *National Interpreters Workshop Proceedings*, 216-219.
- Bissig G. (2008). Mapping geomorphosites: an analysis of geotourist maps, *Geoturystika*, 3(14), 3-12.
- Bissig G., Kozlik L. (2008). Wahrnehmung von geomorphologischen und geologischen Landschaftselementen und Interpretationsmöglichkeiten mittels des 3 Geschichten Modells, In Röhling H.-G., Zellmer H. (Hrsg). *GeoTop 2008 „Landschaften lesen lernen“*, *Schriftenreihe der Deutschen Gesellschaft für Geowissenschaften*, 56, 14.
- Carton A., Coratza P., Marchetti M. (2005). Guidelines for geomorphological sites mapping: examples from Italy, *Géomorphologie: relief, processus, environnement*, 3, 209-218.
- Castaldini D., Valdati J., Ilies D.C. (2005a). The contribution of geomorphological mapping to environmental tourism in protected areas: examples from the Apennines of Modena (northern Italy), *Revista de Geomorfologie*, 7, 91-106.
- Castaldini D., Valdati J., Ilies D.C., Chiriac C. (2005b). Geo-tourist map of the natural reserve of Salse di Nirano (Modena Apennines, northern Italy), *Il Quaternario*, 18(1), 245-255.
- Coratza P., Regolini-Bissig G. (2009). Methods for mapping geomorphosites, In Reynard E., Coratza P., Regolini-Bissig G. (Eds). *Geomorphosites*, München, Pfeil Verlag, 89-103.
- European Manifesto on Earth Heritage and Geodiversity (2004). *Rec (2004) 3 of the Council of Europe on conservation of the geological heritage and areas of special geological interest*. Adopted by the Committee of ministers on May 2004.
- Ham S. (1992). *Environmental interpretation: a practical guide for people with big ideas and small budgets*, Golden, Fulcrum.
- Hose T. A. (1996). Geotourism, or can tourist become casual rock hounds?, In *Geology on your doorstep: the role of urban geology in Earth heritage conservation*, London, Geological Society, 207-228.
- Kealy M. (1998). Mapmaking for parklands, In *Information Design – Tools and Techniques for Park-Produced Publications*, National Park Service, United States Department of the Interior, 31-51.
- Kramar N., Pralong J.-P. (2005). La didactique des sciences : une chance pour les sciences de la Terre, In Dambo L., Reynard E. (Eds). *Vivre dans les milieux fragiles : Alpes et Sahel*, Lausanne, Institut de Géographie, Travaux et Recherches, 31, 43-56.

- Kruhl J. H. (2006). Rahmenbedingungen einer Geotop- und Geopark-bezogenen Didaktik, In Vogt J., Megerle A. (Hrsg.). Geopark- und Geotourismusforschung. Ergebnisse des internationalen Workshops in Karlsruhe 2006, *Regionalwissenschaftliche Forschung*, 31, 41-49.
- Lehnes P., Glawion, R. (2006). Landschaftsinterpretation. Erd- und Landschaftsgeschichte als Freizeit-Erlebnis, *Geographie und Schule*, 159, 23-28.
- MacEachren A. (1995). *How maps work: representation, visualization, and design*, New York, Guilford Press.
- Mariétan I. (1960). Le Val de Derborence, *Bull. Murithienne*, 77, 92-126.
- Martin S., Reynard E. (2009). How can a complex geotourist map be made more effective? Popularisation of the Tsanfleuron heritage (Valais, Switzerland), *6<sup>th</sup> European Congress on Regional Geoscientific Cartography and Information Systems*, Munich, 9-12 June 2009, Proceedings, vol. 2, 261-264.
- Megerle H. (2008). *Geotourismus. Innovative Ansätze zur touristischen Inwertsetzung und nachhaltigen Regionalentwicklung*, Geographie in Wissenschaft und Praxis, Band 1, Rottenburg am Neckar, Verlag Kersting,
- Patterson T. (n.d.). *Developing a new visitor map of Glacial Bay National Park, Alaska*. <http://nps.gov/hfc/pdf/glba-article.pdf> (retrieved 18.02.2009).
- Pralong J.-P. (2006). *Géotourisme et utilisation de sites naturels d'intérêt pour les sciences de la Terre : les régions de Crans-Montana-Sierre (Valais, Alpes suisses) et Chamonix-Mont-Blanc (Haute-Savoie, Alpes françaises)*, Thèse de doctorat, Faculté des Géosciences et de l'Environnement, Université de Lausanne.
- Regolini-Bissig G., Alves A., Brandolini P., Garavaglia V., Ghiraldi L., Giardino M., Hobléa F., Martin S., Pelfini M., Reynard E., Rodrigues M.-L., Theler D., Welc E. (2009). How was Lake Derborence (VS, Switzerland) formed? Popularisation of geosciences by means of a geotourist map, *6<sup>th</sup> European Congress on Regional Geoscientific Cartography and Information Systems*, Munich, 9-12 June 2009, Proceedings, vol. 2, 290-293.
- Reynard E., Berrebi Y. (2008). Percorsi geodidattici e aspettative del pubblico. In *Geologia e turismo - beni geologici e geodiversità. Atti del 3° congresso nazionale, Bologna 1-2-3 marzo 2007*, Regione Emilia-Romagna, Associazione Italiana Geologia e Turismo, 15-21.
- Reynard E., Coratza P., Regolini-Bissig G. (2009) (Eds). *Geomorphosites*, München, Pfeil Verlag.
- Robinson A.H. (1985). *Elements of cartography*, New York, Wiley.
- Schoesberger D. (2007). Evaluating the effectiveness of 2D vs. 3D trailhead maps: A study conducted at Zion National Park, United States, *6<sup>th</sup> ICA Mountain Cartography Workshop "Mountain Mapping and Visualisation"*, 201-205.
- Slocum T.A., McMaster R.B., Kessler F.C., Howard H.H. (2009). *Thematic cartography and geovisualization*, Upper Saddle River, Pearson Education.
- Tilden F. (1957). *Interpreting our Heritage*, North Carolina, University of North Carolina Press.

