PROBLEMS IN RELATION TO THE DEVELOPMENT OF SKI-RESORTS ON THE FRENCH MOUNTAIN KARST

PROBLEMI POVEZANI Z RAZVOJEM SMUČARSKIH SREDIŠČ V FRANCOSKEM GORSKEM KRASU

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Fabien Hoblea: Problemi povezani z razvojem smučarskih središč v francoskem gorskem krasu

V Franciji je v gorskem krasu okoli 60 smučarskih središč. V zvezi z njihovim razvojem so na krasu specifični problemi, predvsem relief in podzemeljska voda. Cela vrsta dejavnikov je neprimernih za razvoj velikih središč na krasu in veliko napak je bilo storjenih prav zaradi nepopolnega poznavanja kraških značilnosti, ki so pogosto sploh prezrte. Zaradi tega bi morali biti krasoslovci oziroma geomorfologi povabljeni k sodelovanju pri planiranju na kraških področjih.

Ključne besede: kraška morfologija, človekov vpliv na kras, turizem, smučarski turizem, Alpe, Francija

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Fabien Hoblea: Problems in relation to the development of ski-resorts on the French mountain karst

In France about sixty ski-resorts are located on mountain karst. There are specific problems of development in karstic areas, mainly with relief and groundwater. A lot of factors make mountain karst unsuitable for big tourism installations, and a lot of mistakes are made because of incomplete knowledge of characteristics of karst, which are often over-looked. For this reason the karstologist or the geomorphologist should be asked to take part in development planning of karst areas.

Key words: karst morphology, man's impact on karst, tourism, skiing tourism, Alps, France

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AN UNFAVOURABLE GEOGRAPHICAL AND GEOLOGICAL LOCATION FOR BIG SKI-RESORTS SETTLEMENTS

In France, ski-resorts in karstic areas are located in three massifs (Fig. 1):

a) JURA: which is completely a mid-altitude mountain massif with the top at only 1700 m high.
b) PYRENEES: where there are not a lot of ski-resorts in karstic areas, but where we can find an important one: La Pierre-Saint-Martin well known for its famous sytem of caves and shafts.
c) ALPS: where "karstic" ski-resorts are almost all located in the subalpine zone in the western range of the massif, with mainly a mid-altitude environment.

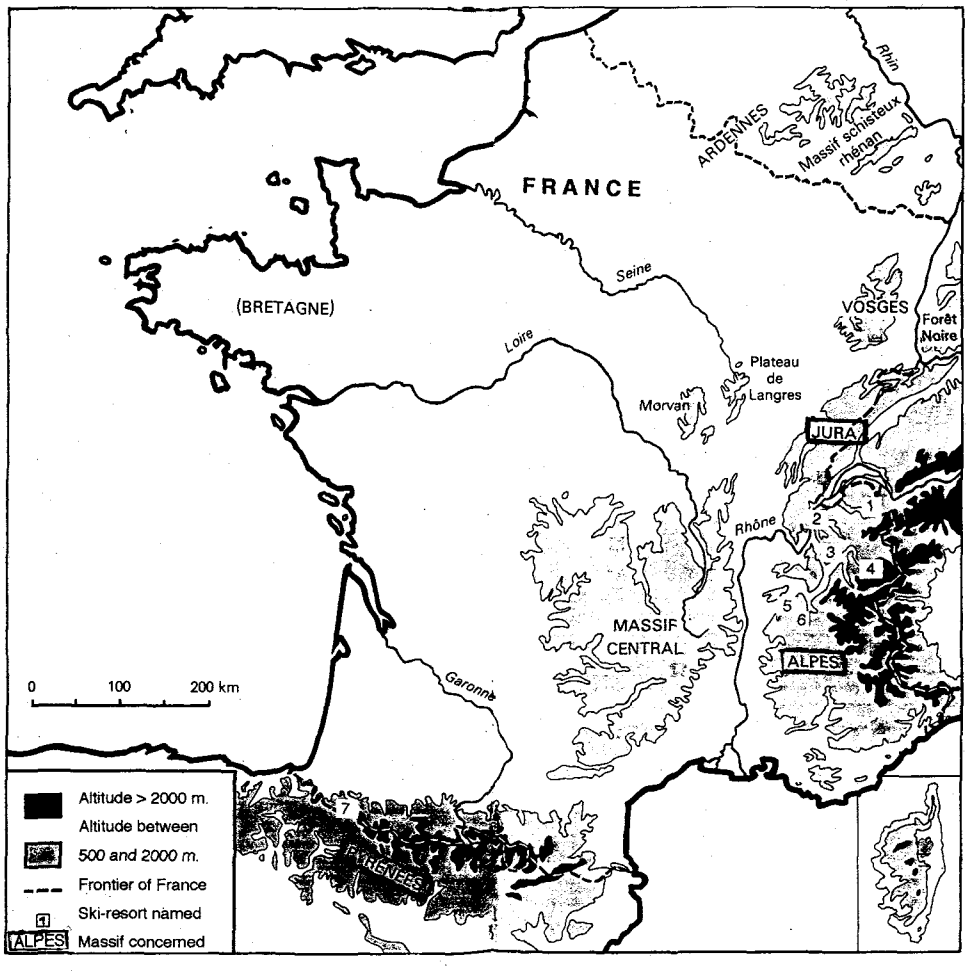
There are of course exceptions in the eastern French Alps, especially in Vanoise where we can find a few big famous ski-resorts on gypsum or marble-limestone. For example Tignes, or La Plagne, with ski-areas of high-mountain. Human impacts in this last kind of ski-resorts have been studied by the geomorphologist Rovera (1990).

But generally, the ski-resorts concerned are small, because of their geological environment, as we can see with two examples in subalpine massifs: Vercors and Bauges (Fig. 2). This figure shows how unfavourable are the lithostructural conditions for downhill ("alpine") skiing:

- Low slopes and low denivelations, with a morphology of "plateau" rather more suitable for nordic ski. But in France, this kind of skiing is not so popular and so profitable than downhill skiing, and it is a must for such ski-resort to offer ski-lifts for their clients; even these ski-lifts often lead to ridiculous ski-tracks.
- Mid-altitudes where the snow is not guaranteed, especially for the last five winters. This bad climatic circumstances for winter sports have put some ski-resorts in a very delicate financial situation.
- But confronted by this new problem, the managers often count on always more development, extension and modernization (like for instance snow-guns); and sometimes, the karst will pay the bill, particularly the karstic landscape...

CONTRADICTION BETWEEN THE SKI-RESORTS DEVELOPMENT AND THE CONSERVATION OF KARSTIC SUPERFICIAL LAND-FORMS AND LANDSCAPE

"High-alpine" or "woody mid-altitude" karsts, give a topography which is naturally very broken with numerous micro-dolines, rock-rills, steep slopes, pits



1 : Flaine (Haute-Savoie) ; 2 : *Grand-Plateau-Nordique Revard-Féclaz (Savoie)* ; 3 : *Margériaz snow-stadium* (Savoie) 4 : La Plagne (Savoie) ; 5 : Autrans-Méaudre (Isère) ; 6 : Villard de Lans (Isère) ; 7 : Pierre-Saint-Martin (Pyrénées Atlantiques)

Fig. 1. Place of masiff and ski-resorts named in the text.

and so on... It is a necessity for the manager to eliminate completely shallow landforms not only in the layout of the ski-tracks but also for the building, parking areas etc... Two examples of ski-resorts make us aware of the importance of the destruction: La Pierre-Saint-Martin (Pyrénées), and the Margériaz snow-stadium in the prealpine massif of Bauges, near the savoyen town of Chambéry.

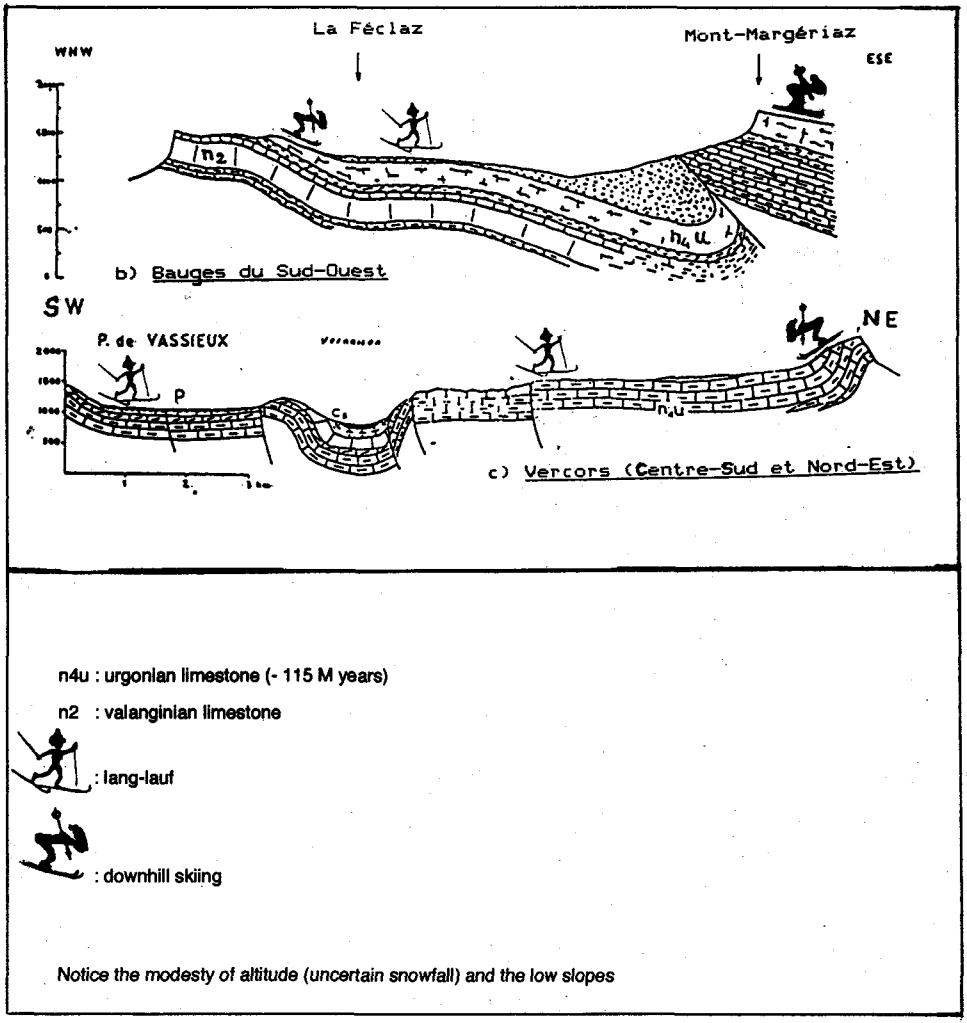


Fig. 2. Examples of lithostructural conditions for ski-resorts in karstic areas.

a) **La Pierre-Saint-Martin: a famous site defaced**

The ski-resort is here established on a remarkable karstic area, not only because of its speleological system, which is 1342 m deep, but also because the shallow karst offers a big scientific interest. The karst of la La Pierre-Saint-Martin is assuredly one of the jewels of the karstic heritage in the world. But the settlement of the ski-resort has led to massive destruction of karstic landforms in a first time in the grass area, and afterwards in the bare karst, where the scars are indelible. In this natural site "without equivalent in the Pyrénées" (Viers 1989), one of the last refuges for the big vulture, drastic measures were used: of course very big caterpillars (bull-dozers, scrapers...) but also specific machines newly conceived to destroy and to crush hard rock and especially reef limestone, like for example a little tracked-vehicle supporting a drilling machine which makes holes to put explosives inside. And these explosives are certainly the main weapon against limestone: the quantity of explosive used by ski-resort working in karstic areas is comparable to that for a dam working or a quarry (related to the lenght of the working).

In the site of La Pierre-Saint-Martin, we can observe an economic impact of the destruction of the landscape around the ski-resort: because the works are recurrent each summer, because the clients want now to frequent the mountain in summertime like in winter, in a beautiful environment without noise, defaced areas and so on, and for other reasons which do not concern our topic (ageing of the buildings...), the market of the building park of the ski-resort in crisis.

And more, safety in the ski-area is a very important problem, because of the presence of very numerous deep shafts. In winter, when the snow obliterates the scars, the pits are covered too, and become fatal traps: already three skiers died like this in the Pierre-Saint-Martin. It is of course not a good publicity for the site.

For all these reasons, the place is now not so attractive for the French side and the management team looks for new clients on the Spanish side nearby. That presupposes making new ski-tracks through the most fragile zone of the karstic plateau; that means new destructions and so on, like a vicious circle...

The same process is going on in our second example, but for other reasons.

b) **The snow-stadium of Margériaz (Savoy)**

The advertisement is clear: this snow-stadium (ski-resort without accomodations), set up on a monoclinal slab of Urgonian limestone, wants to be "the biggest snow-stadium in France" (advert-leaflet 1993). In fact: a ski-area of 45 ha, 400 meters of denivellation between altitudes of 1400 m and 1800 m, 15 km of ski-tracks, 10 ski-lifts and 7500 skiers/h. So, a modest place for skiing in the French scale. But not negligible, because of its location, near big cities (Chambéry-Aix les bains, Annecy, Lyon) and an easy and fast access.

For five years, this site has suffer particularly from lack of snow which is

recurrent and general in mid-altitude mountains. In this situation the surface of the ski-tracks must be absolutely smooth for skiing with only 20 cm of snow thickness. All the ski-tracks have been treated with huge quantities of explosives, with tracked-drills and stone-crushers... Artificial embankments have been built when the slope was not adapted for downhill skiing. It results in an artificial landscape which shows large scars on the karstified slab with a very important contrast of colour between the superficial colour of the Urgonian limestone (grey) and the internal one (white or clear beige). This contrast is clear on a vertical aerial view of the site (Fig. 3). In the detail, we can of course observe destruction and disappearance of karstic landforms replaced with banal stony material (fine granulometry), not only on the layout of the ski-tracks, but also partially in the area around, because of the projections of stones by the explosives. We also can see rubbish in dolines, and a symbolic absurdity: a few trees rooted in concrete. Here too, the summer landscape has been sacrified, and such a situation is now the problem

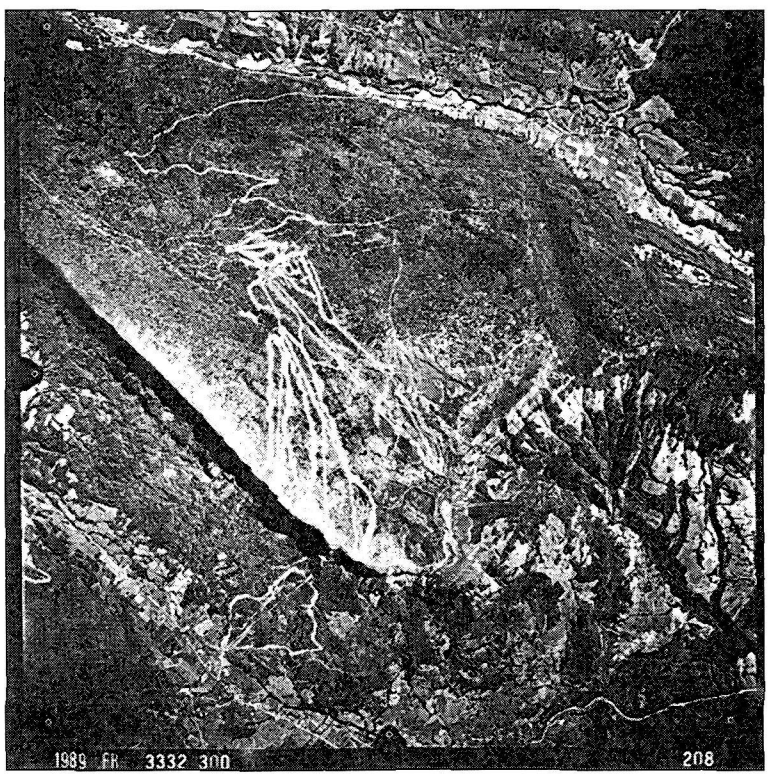


Fig. 3. Vertical aerial view of Mount Margériaz (1845m, Bauges, Savoie)

in the prospective creation of a natural regional park in the Bauges massif. On the Margériaz mount, since the destroying works, tourists run away in the summer season and the rare hikers have negative opinions about such a landscape (survey made in 1989, Hoblea 1990a). It is one of the reasons why some expensive efforts are made to turn the ground green (Daburon 1989).

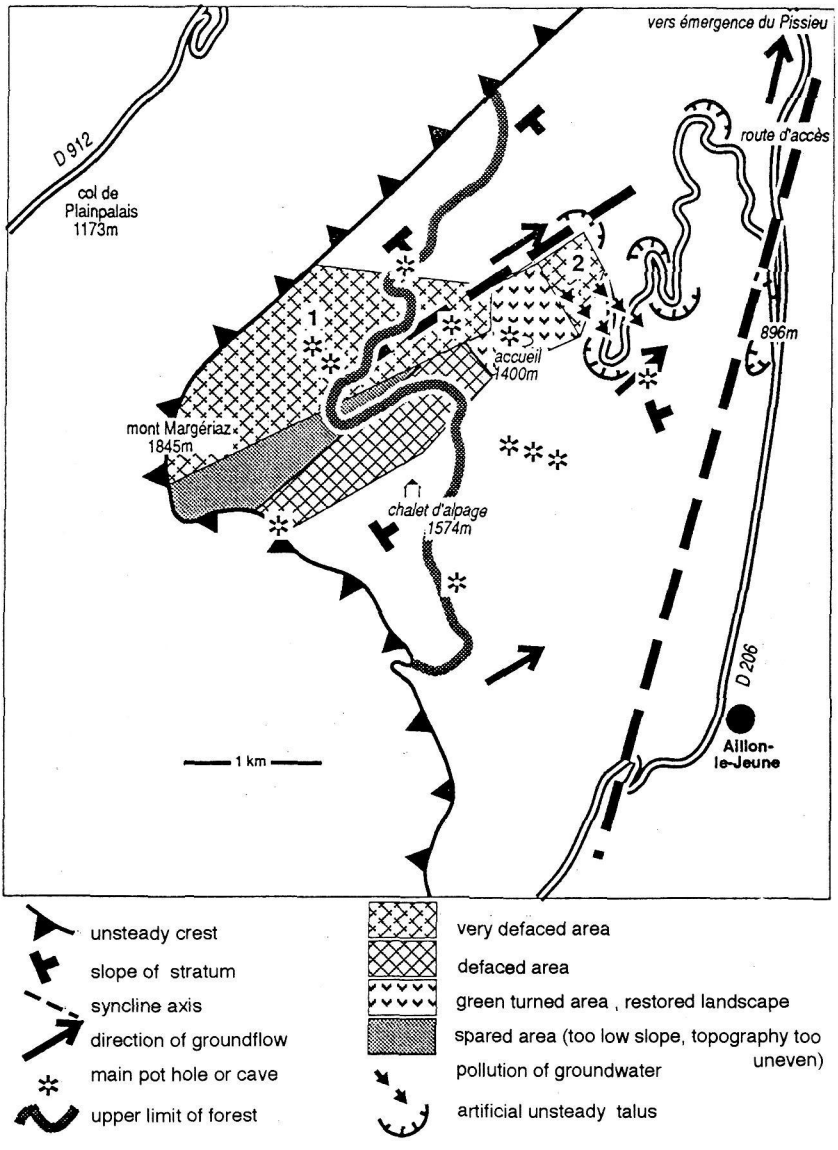


Fig. 4. Margériaz snow-stadium - impacts of dvelopment on the karst.

But on such mountain karstic soil, these efforts are not often sucessful, and only a few plates of brilliant green lawn of clover can subsist (that is not the natural colour and composition of the local vegetation), showing the actual limits of rehabilitating landscape in karstic areas. The karstologists should make an inventory of all these kinds of human impacts on mountain karst and locate them on a map like the one proposed on the Fig. 4 (simplified map because of the small scale necessary for this publication).

Like in the Pyrénéan example, the Margériaz snow-stadium has problems about the safety of the ski-area. We have listed more than ten falls of skiers in pits, luckily without serious injury... And the works in the ski-area or in the roads around usually open new cavities. For two years, after the suggestions of the speleo-rescue and the "civil protection office", the manager of the stadium has agreed to inform the public of the existence of shafts and caves on the massif (there are more than 300 entrances listed by the cavers on a speleological map, and among them, the deepest cave of Savoy: the "Tanne Froide/Tanne aux Cochons" system: -825 m) and more, the staff who work in the ski-area get a training about the technics of speleo-rescue.

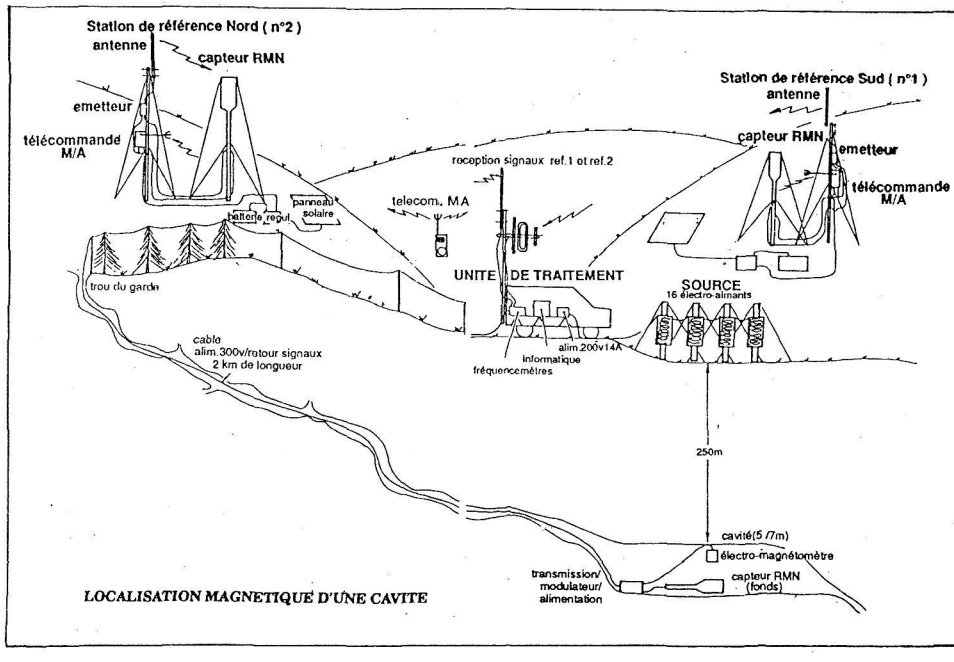


Fig. 5. Method for magnetic location of karstic cave - example of the "Trou du Garde" (La Féclaz, Savoie, France). (LETI laboratory, Grenoble, France)

In spite of the difficulties caused by the karstic topography, and the bad climatic circumstances (lack of snow in winter), an important extension of the ski-area is planned, including a link by ski-lift with the bottom of the valley at an altitude of ... 900 m! A plan for equipment with snow-guns is prepared, which could take the water inside the karst, in spite of a very little flow in winter (around 1 l/sec!). Are this (very expensive) plans very serious? Managers and local elected representative think so...

Anyway, we reach here the problem of the karstic water as resource for touristic development.

WATER RESOURCES AND TOURISTIC DEVELOPMENT IN KARSTIC MOUNTAINS

The lack of shallow water and associated water table, the depth of the underground water streams (in average more than 150/200 meters of hard limestone), which are in mountainous karst canalized in narrow channels without filtration, make the water supply for a big touristic settlement difficult. Until five years ago, it was an insuperable handicap for the development of the capacity of accomodation (the formula of the "snow-stadium" among others is imposed by this natural constraint). But for about seven years, the interest in karstic underground water is woken up by the progress of the magnetic method of location of karstic cavities and by the progress of the deep drilling technique. To bring up water from the depth of the karst became possible. In France, a little old ski-resort of the Bauges massif, called La Féclaz, has been the pioneer to test this methods. The drilling operation was success, but then arose the question to protect and to clean up the water...

a) **The drilling of La Féclaz**

At the end of the 1980s, because of the creation of a big nordic ski-area in the massif around it (operation "Grande Plateau Nordique"), the ski-resort of La Féclaz wanted to develop its capacity of accomodation with 4000 new beds (1700 beds were available at this time). But the precondition to realize this aim was that La Féclaz find more water. The ski-resort is settled above a very important speleological system 25 km long (the "Garde/Cavale"), which offers several underground torrents but more than 200 m deep inside the Urgonian limestone. The solution of drilling was selected, made possible by the discovery of new process for the location of deep cavities by a French laboratory at Grenoble: the LETI (Fig. 5). With the collaboration of the cavers, it was a total success and the 21 november 1987, after 213 m of drilling, the drill reached its target with only 20 cm error! But before pumping up the water (30 m^3/h planned), La Féclaz had still to wait several years because the protection and the cleanness of the water was not guaranteed.

b) **The difficulties of protecting and cleaning up the water**

The construction of a cleaning station and the joining up of each building

was of course the priority, because all the dirty waters went directly into the karst through dolines or shafts. So, the inhabitants and the tourists could drink their own used water, as has happened in the past in a settlement of the Jura!. The protection of the underground water resource was therefore a necessity and a priority: but what is the solution to protect un undeground water system sustained by a superficial basin whose boundaries are very difficult to know with the required precision, and that fluctuate according to the seasons and the meteorological circumstances? And more, what kind of measures could be used to protect a basin which corresponds to the ski-area subject of the development, with works, deforestation, and so on? It was the question asked to the mayor of the ski-resort who thought that the best way to protect his drilling was to forbid the caving practice. The intervention of an hydrogeologist, a karstologist, and caving representative made the mayor conscious that it was a derisory and vain solution if in the same time the danger represented by some shallow activities (among which were touristic ones) was not eliminated... Now caving is regulated in the Trou du Garde, but the shallow activities too, especially the management of rubbish collection. A big collapse doline called "Creux de l'Olette" has been (only partially) cleaned up with scrapers, and several tonnes of rubbish, sometimes toxic, have been taken out of this famous hole. And finally, the investigation and the study of this very interesting hydrogeological and speleological system can go on...The drilling of La Féclaz shows how difficult and complex it is (if is now possible in a technical point of view) to use karstic underground water in a growing touristic area. Other examples confirm this fact, like the drilling of Autrans-Méaudre in the Vercors realized through 300 meters of hard limestone in the famous "Trou-qui-souffle".

CONCLUSION

In conclusion, the problem of the touristic development on karstic mountains in France can be summerized in this paradox: small and non-profitable ski-resorts, but maximal natural contraints and big damage to the environment and the landscape, damage which compromise the development of a "soft" or "green" tourism in every season (especially in summertime) that these regions try moreover to attract. There is here a fundamental contradiction.

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PROBLEMI POVEZANI Z RAZVOJEM SMUČARSKIH SREDIŠČ V FRANCOSKEM GORSKEM KRASU

Povzetek

V Franciji je v gorskem krasu v Juri, Pirenejih in Alpah okoli 60 smučarskih središč, nekatera (Tignes, La Plagne) so celo v visokogorskem krasu na sadri ali marmorjih. V zvezi z njihovim razvojem so na krasu specifični problemi, predvsem relief in podzemeljska voda. To skušajo reševati z obsežnimi tehničnimi ukrepi na površju in z različnimi vodogospodarskimi ukrepi, vključno z globokim vrtanjem do vodonosnih plasti. Posebne težave so z varovanjem podzemeljske vode in s čiščenjem odpadnih voda.

Cela vrsta dejavnikov je neprimernih za razvoj velikih smučarskih središč na krasu in veliko napak je bilo storjenih prav zaradi nepopolnega poznavanja kraških značilnosti, ki so pogosto sploh prezrte. Pojavlja pa se tudi zanimiv paradoks: majhna in nerentabilna smučarska središča povzročajo največje pritiske in škodo okolju. Zaradi tega bi morali biti krasoslovci oziroma geomorfologi povabljeni k sodelovanju pri planiranju na kraških področjih.