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Some Observations on a Sojourn Through Europe, Part I

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The following is a brief account of my four months' journey through Europe, with special reference to various geological phenomena observed. However, I shall not confine myself exclusively to geology since occasionally it is beneficial to digress because the sciences of geology and mineralogy are so intimately bound up with human affairs. Often when observations are presented in a somewhat subjective vein they are more meaningful and more interesting even if less accurate than when presented from a purely scientific standpoint.

I left my home in New York the first week in June, 1949, travelling by train and thumb to Quebec City, Quebec, Canada. From Quebec we sailed on the Cunard White Star Liner, Samaria, and after a somewhat rough crossing of 8 days we docked in Tillbury near London, England. Of course on the last leg of our voyage we didn't miss seeing the world famed "White Cliffs of Dover." Actually these chalk cliffs are found on both sides of the channel and are not limited to the vicinity of the city of Dover. These deposits consist of soft, white, friable rock composed of what were once shells and fragments of foraminifera. Extensive beds are found over northern France and Belgium and the south and east of England. These beds were once continuous across the Channel and over much of the North Sea, while at the same time they extended as far to the northwest as northern Ireland. Cliffs which are now present to the sea are a result of subsequent erosion. Flints in the chalk are the result of secondary segregation of silica which originally was scattered thru it, and which originated from the silicious skeletons or other parts of marine organisms. The late Albert Charles Seward, the famous English paleobotanist, in one of his books described the origin and structure of these deposits. In this work he discussed a series of fossil "sea-urchins" found in these cliffs that could be used as index fossils. That is, it was possible to tell the age of a particular sedimentary chalk deposit by the type of fossil sea-urchins you found there.

From Tillbury it's only a short train ride to the heart of London. I spent several days there seeing all the sights that every tourist in London for the first time "must see." One of the most interesting was Marble Arch in Hyde Park where speakers air their views on every conceivable subject. Then by train to Fo'kestone and by ferry to Calais in France. Since this was my first trip to Europe anything that differed from my previous experience was of great interest to me. Calais is in very bad shape. The whole harbor area has been badly damaged and is now only partially rebuilt. I cycled thru northern France to Rheims and from there took a train to Strasbourg. A short stop there during which time I crossed over into Germany very briefly, then over the border to Basel in Switzerland.

Journey Through Switzerland

Now Switzerland as everyone knows is the land of high mountains and the home of thrifty and industrious people. However from a geological and mineralogical point of view it is one of the most interesting countries in Europe and there is a vast fund of information available about the various aspects of Swiss geology. One of the pioneers in this field was Louis Agassiz who later came to the United States. His chief fame as a geologist may be attributed to his monograph on Fossil Fishes and his glacial studies. He first suggested the possibility of continental glaciation from his studies of grooves and striae identical with those found in the Alps.

Cycling from Basel to Lucerne was easy and fascinating but it was after crossing crystal clear Lake Lucerne that it became difficult and later almost impossible. The way chosen over the Alps was the St. Gotthard Pass which begins near the town of Altdorf, the birthplace of William Tell. All along the route from Flueelen (near Altdorf) on Lake Lucerne up to
the summit of the pass many varieties of minerals are sold in dozens of different shops at moderately high prices. A few shops such as the one in Andermatt are devoted exclusively to the sale of minerals and this particular one has an exceedingly fine display. The proprietor told me that he had sold many specimens to the British Museum and was quite annoyed at the fact that I didn't wish to make any large purchases. Nevertheless he was very courteous and helpful even to the extent of giving me the localities of all of the minerals I purchased.

However in most of the stores it is just a sideline. The minerals are also sold at roadside stands and in general stores along with postcards, and groceries. Most of the specimens are found high in the mountains in caves and other places and are difficult to reach, so since I didn't have too much time I didn't do much collecting on my own. Quartz crystals are, as you would expect, most abundant in an infinity of shapes, forms and varieties. You can buy anything from a huge rock slab full of quite well formed crystals for about $25.00 to a small poorly shaped specimen for a few cents. There are some professional rock collectors in this area but most of the specimens are picked up by the mountain peasants when they go the high mountain slopes with their herds in the summer time.

Most of the minerals available in Switzerland can also be found in the United States, so to spend much time in the description of the minerals themselves would be fruitless. Some of the characteristic minerals of Switzerland are epidote (fine crystals), kyanite, staurolite, beryl (aquamarine), rare metallic sulfides and hematite crystals also garnet. The Alps themselves are distinctive of Switzerland and are a unique feature of this part of Europe. Previously I have had an opportunity to visit the Canadian Rockies and the two ranges present quite a contrast both from a geologic and human point of view. The Canadian Rockies are part of a general range of mountains running from Alaska to the Andean chain in South America. On the other hand the Alps form but a small portion of a great zone of crumpling which stretches from Morocco to beyond the Himalayas. The St. Gotthard Pass itself is part of the central Alps, which are composed largely of sedimentary rocks; it is 6,935 feet high at the summit. This region is famous for the various types of garnet and tourmaline found in the general area.

Most of us at one time or another have heard of these little mountain villages tucked away in obscure corners of the Alps. I've always had a yen to visit some so when I stopped at the town of Goschenen on the way to the top of the pass I took advantage of my opportunity. This particular hamlet is called Goschenen Alp and is at an elevation of 5,625 feet at the foot of the Damma Glacier. The town of Goschenen is only, it an elevation of 3,640 feet so it is a rather steep climb in places. The village is reached only by mule trail and it takes about three hours of steady walking from the main highway. But the scenery is really marvellous. Here is the perfect example of the youthful valley with its pronounced V-shape and swiftly flowing river. The trail is very rocky but the ascent is gradual in most places and one only has to be careful not to trip on a loose rock and sprain an ankle.

On the way up I met the postman accompanied by his mule on his way to deliver the mail and some supplies. He walked at a slow, leisurely pace, and was not nearly as anxious as we to reach our goal. The slopes are extremely steep and are covered in most places with evergreens. But all along the way as we climbed we saw the homes of the local farmers perched precariously on the hillsides. No matter how steep the slope there always seemed to be people trying to earn a living from the land. Later I was to notice the same condition in Norway. I could see both the men and women working in the fields and gathering in their newly cut hay. All along the way were little shrines and even a few grave markers. Wrestling a living from the land is extremely hard work and the local people are devoutly religious.

The small river which runs down the center of the valley is ice cold, since it contains melted snow derived from the glaciers in the mountains. The water is a dark grey in color because it flows so swiftly that it carries a great deal of sediment in suspension. The size of the river varies with the seasons, being biggest in spring when the snows melt. Since it was now summer it had receded somewhat, and we passed through large areas of water-worn boulders normally part of the river bed during the spring thaw. Every now and then we would pass a cataract where the river dropped suddenly, creating a series of small but impressive waterfalls.

At last we came out on a level plain and in the distance saw the little cluster of houses that constituted the village. All around us were towering peaks girdled with glaciers, Goschenen Alp consists of a few small cottages, a church and
small hotel. While sipping a glass of fresh and delicious ice cold milk at one of the houses I met a man in his middle sixties who was going to climb over the mountains alone. He had all his gear (pickax, hobnail boots, ropes, rucksack etc.) with him. Since he had lived in the region all his life, I guess he didn't consider it much of an accomplishment.

**Journey Through Italy**

Leaving Goschenen I pushed my bike up the rest of the pass and then coasted down into the Italian part of Switzerland. After spending several lovely idle days at Lake Lugano, I crossed over into Italy and Lake Como which is not nearly as nice as Lugano. From Como we went by bike to Milan and then from there took the train to Venice. Here I went for a swim in the warm and calm Adriatic at the Lido, one of the nicest and cleanest public beaches I've seen anywhere. Of course the Piazza St. Marco, the Doge's Palace, and a tour of some of the islands in the archipelago are tourist "musts" in this city.

By train I proceeded from Venice to Florence and from Florence to Rome. Third class train travel in Italy is very difficult, to describe the situation mildly. I guess first and second classes are somewhat better. Much rolling stock was damaged during the war, and there is a desperate shortage of coaches; as a result all trains are extremely crowded. To anyone contemplating a trip to Italy travel by the new and modern busses is strongly advised.

It is needless to describe here the many wonders of the eternal city. However, the catacombs and the old Appian Way, both on the outskirts of the city, are sights I think no one with a geographical leaning should miss. My next stop after Rome was Naples, located in the southern and poorer part of Italy. The people, however, in spite of their marked privation are friendly, cheerful and especially favorably inclined towards Americans. Of course I visited Pompeii. Mt. Vesuvius is quiescent for the present, but in an eruption several years ago a thick layer of volcanic ash was spread on the surrounding countryside including Pompeii. There is a fine museum here and good guides to take you thru the ruins. A guide is absolutely necessary because the ancient city covers a very large area only part of which has been excava-

wated and it very easy to get lost.

The following day I visited Capri which is located out in the Bay of Naples some distance from the port of Naples. It is most easily reached by steamers which leave regularly from the main harbor. The Isle of Capri is about four square miles in area and forms a prolongation of the peninsula of Sorrento. It consists of two ridges of Apennine limestone which differ in height and form huge cliffs, about 900 feet in height, rising abruptly from the sea. The limestones are similar to the Urgonian or lower Cretaceous of Sicily. It is also interesting to note that a superficial layer of volcanic tuff occurs in several parts of the island.

As soon as the ship docked I took a small motorboat to the famous Blue Grotto (Grotta Azzurra). Outside the entrance to the cavern passengers are transferred to specially built small boats which take them inside the Grotto. It is a rather unsatisfactory experience, largely because the boatmen take you in and out so quickly. You have to duck down as you enter because there is only one opening of about three feet, three more feet of the entrance being under water. The

Grotto itself is oval in shape and is about 100 feet wide, 165 feet long, 10 feet high and the water is 48 feet deep—all in all it is a fairly large cavern. A submerged opening gives the cave a beautiful blue light and the water is extremely clear. The Romans probably knew about this cave and used it, but the optical phenomenon which is its chief claim to fame probably did not exist at that time, later I'll tell you the reason why.

In the afternoon with a companion I swam from the village along the shore in the opposite direction and "discovered" some small grottoes. These cannot be entered by boat and one usually has to do a surface dive to gain entrance. Inside the water is just as blue as in the larger cavern. Various shades of green, orange, and yellow seem to dance over the walls, and looking down you can see clearly every rock on the bottom. It appears as if you could just touch them even though they may be fifteen or twenty feet beneath you.

To the geologically curious these caves on Capri present several interesting questions. How were they formed? Why do the Romans make no mention of the
optical phenomenon in their voluminous writings? Certainly one cannot answer these questions with any definite finality but at least some fairly reasonable explanations based on observed evidence have been presented. As to how the caves were formed the most obvious answer is by sea erosion. This is partially true, but according to observations the sea only works within a limited horizon, and therefore the big caves cannot have been formed by the action of the sea alone. There are two possibilities: either the level of the Bay of Naples has changed several times or the elevation of the land has been altered. Careful observation leads us to the latter conclusion. Horizontal beds of limestone on the island have been tilted so as to dip with an inclination that increases from east to west. Also marks of marine erosion have been found 23 feet apart at the east end of the island but only twelve feet apart at the west end, a rather uneven change that can be accounted for only in terms of alteration of the level of the land. It follows from this that the optical phenomenon of the caves probably did not exist in Roman times because the land level was somewhat different than it is today.

In Switzerland Again

After leaving Naples I travelled north into France along the French Riviera and then inland by a devious route to G Reneb.

Rocks and Minerals

noble in the French Alps. This town is noted among other things as being the locale of Balzac's novel The Country Doctor. From Grenoble I biked overland thru the Alps to Geneva and from there went by train to Zermatt. All railways in Switzerland are electrified and Swiss trains run almost as well as Swiss watches. A ride from Geneva to Zermatt takes about six hours with one change, that is a transfer from the regular railway to a mountain railroad built from the main line to Zermatt. The town itself is only at a height of 5,300 feet but it is directly at the foot of the Matterhorn, one of the most famous mountains in the world, which towers into the clouds above the valley. Its scenic grandeur is due not only to glacial erosion but to the fact that this type of erosion has acted upon the tough, cliff-forming gneissic rocks which cap the relatively weak "Schistes Lustres." This last term constitutes the metamorphosed equivalent of shale. The different outcrops in Zermatt itself and in the Gorner gorges are all built up of greenstones. These greenstones contain gabbros, amphibolites, and serpentines. On the mountain itself the most important formation is the Valpelline series of a much darker color than the other formations and recognizable from a distance. This series consists of marbles with minerals characteristic of contact metamorphism, such as diorites, gabbros, peridotites, granite with muscovite, and gneiss with garnet, sillimanite, andalusite, and graphite. The present valley at Zermatt is a result of an uplift of 7,500 feet at the beginning of the Quaternary and as such is a "rejuvenated valley."

From the town of Zermatt a cog railway goes up to the Gorner Grat at an elevation of 10,280 feet. From there a beautiful view of the Matterhorn and surrounding mountains and glacier is obtained. It is really a magnificent spectacle to behold. From Zermatt I travelled thru various parts of France and finally arrived at Paris during the third week in September. About a week later I set out through Scandinavia on the second part of my journey.

References

2. The Structure of the Alps—Collet.