

XXIII.—*Supplementary Notes on the Val d'Anniviers.*

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REFERRING to my notes in number 3 of the Mineralogical Magazine for 1877, I observe one or two little matters which I hoped the march of time would improve. One desideratum, a good hotel, the Hotel d'Anniviers, has been established at Vissoie, and M. Monnet, the landlord, is a man of intelligence, and, without pretending to scientific lore, has much information concerning the mining, geology, botany and history of the neighbouring valleys. Jean Martin, my guide in many a tough scramble, has married, and established a small restaurant with a couple of bedrooms at Vissoie, which place may now fairly be said to have become a centre for many interesting excursions; as, to the Bella Tola, whence the panorama is very grand,—to the Cols leading from the Grimenz Thal to the Val de l' Arolla and Evolena, and also to the Turtman Thal, and so across to St. Niklaus in the Zermatt valley.

On the other hand, they have not carried on the char road to Zinal, and a mule path it still remains. Nor have they, in spite of the frequent urgings of myself and other travellers, built a little Inn on the Alp d' Arpitetta, whence is one of the sublimest views of the giant mass of the Weisshorn, and which is in itself a good sub-centre for mountain expeditions.

The summer of 1878 was very unfavorable for mountaineering, and I was unable, during a week spent in the valley, to explore the rock masses at its head as I had hoped to do. It is a sad reward of a hard climb of some hours to be beaten back by bad weather from the spot almost within reach where one could have solved some problem with but little further bodily labour. I was not fortunate. Still I became generally acquainted with the nature of the rocks forming the sides of the great glacier basin at the valley head.

Ten minutes' walk from the hotel at Zinal, on the west side of the roaring Navigenze, is a curious mass of dolomitic rock, with occasional occurrence of gypsum, and efflorescence of saltpetre. This rests on what Gerlach considers as "elder metamorphic schist." Above this dolomite, half-way to the summit of the Garde de Bordon the rocks are composed

of M. Lory's "schiste lustré," which has been referred to the Triassic age by good authorities. I was twice prevented from climbing to the point of junction of these masses, and on one occasion got myself into a difficulty of which, as an old Alpine man, I felt rather ashamed. My object was to see the relations of the dolomite with the schists above it. Half-way up the Garde de Bordon this "schiste lustré" yields place to a hornblende schist, also commonly referred to the Trias. Many of the Swiss savants, M. Renevier for instance, refer all dolomites in that country and all gypsum, except of course mere fragments, to the lowest of the Lias or the highest of the Trias; we may say to the lower portion of the Rhœtic beds. Now it appears to me that the evidence to be gained by an effective exploration of this dolomite will be of much value, as regards both its own age and that of the schists above it, accepted, I believe, as of Upper Triassic age. The question is a complicated one. Gerlach, in a section through the Dent Blanche, accompanying his "Karte der Peninischon Alpen," represents the mass of that peak as consisting of Talcose Gneiss, whilst fan-like strata crop steeply out on the N. and S. flanks, the synclinal axis being apparently right under the base of the mountain. Amongst these strata he places the "schistes lustrés" higher than the dolomite. With due deference to the undoubtedly high authorities I have consulted, with no facilities in the way of libraries nearer than Lausanne, I look forward to an opportunity of overhauling the evidence as to the age of schists and dolomites with great interest.

A fortnight ago I had the advantage of exploring the salt mines near Bex, under the guidance of a distinguished Swiss geologist, Monsieur S. Chavannes who, having formerly been Pasteur at Bex, and also at Les Ormonds for many years, became exceptionally familiar with that district. Of what I saw underground I have not now to speak, but one thing I did most certainly see in the gypsum-bearing strata round Bex was that the metamorphosis of limestone rock into gypsum is going on palpably under the very nose of the explorer. I say this without prejudice to the question whether or not these great masses of gypsum owe their origin to the evaporation of seas. In the mine is an escape of gas which, after a strong explosion, has been kept constantly burning for some time past. Also I have now on my hands the analysis of an efflorescence or, rather, a deposit on the wall of the adit, containing carbonates of lime and magnesia, and also free sulphur and sulphides. The inference is that organic matter, oxygen and sulphur are at the present day all available, and with these much natural "manipulation" of rocks must take place. I am not prepared to pursue this subject, which is a large one. But replacements, hollows from gas bubbles, vesicular rocks and such like evidences are to be met with at each turn, not merely in the mines, but "at grass."

A question somewhat similar to that of the Val d'Anniviers arises with regard to the rocks on the E. side of the Simplon Pass. The second of two sections published in the "Bulletin de la Société Vaudoise des Sciences Naturelles," March, 1878, illustrating a paper by Professor E. Renevier, on the "Massif du Simplon" is well worth procuring, and is published as a separate pamphlet by Rouge et Dubois, of Lausanne. In the valley of the Rhone the following beds in descending order are represented as separating "schistes noirs" to the north from "schistes lustrés gris" to the south, and as dipping something like 40° S.—schiste lustré, gypsum, dolomite, gypsum and schiste noirs. Here we have much the same difficulty in realizing that *if* gypsum and dolomite are lowest Lias or uppermost Trias, the age of the schistes lustrés can be, as Gerlach has it in his map, also Triassic. If, as is proved, he is right, we have a very pretty bit of evidence, in the repeated association of these rocks in these two localities, as to the age of two great masses of schist, evidence all the more important from the paucity of fossils in this country. Mineralogical facts are, as regards the schists of the Pennine Alps, the probable key to their geological age. In this section of the Simplon route there are other questions worth the time and close attention of the field investigator.

The "schistes lustrés" of the Valais are separated from gneiss and from other quite distinct schists on the flanks of the Wasenhorn by a bed of dolomite dipping N. at an angle of about 80° . Here have we a dolomite of the same age, a replication of the other?

The Simplon, I may be allowed to add, affords yet another question for the geological mineralogist. The mass of schist forming the Monte Leone is divided in two places by bands of saccharoid limestone dipping N. at steep angles, and very similar in nature and thickness. A third band separates these schists from the gneiss of the Val d'Antigorio, and this third band, again, has the same character and a similar dip.

Professor E. Renevier, a distinguished geologist, observes the importance of ascertaining whether these calcareous bands are identical, with replications, faults, or other causes for their apparent repetition, or whether they alternate with the enormous masses of schist in which they occur. He remarks, as I do with regard to the dolomite and gypsum of the Val d'Anniviers, that they may be the means of throwing light upon the ages of the metamorphic rocks. To quote his own words:—"Celui qui réussirait, en effet, à démontrer que nos trois bandes calcaires ne sont que trois affleurements d'un même banc, tiendrait la clef orographique de nos Alpes cristallines, car l'élucidation de ce point aurait une portée générale pour l'ensemble de la chaîne des Alpes." This is so mineralogical a question that it excuses the length of my geological dissertations.

Both these details can probably be worked out with no actual hard climbing, though not without considerable walking labour, in the midst however of very magnificent scenery, in unbackneyed parts of this country.

Returning to our valley, I quote the words of my notes respecting the rocks opposite Zinal which "have partly fallen down, many of the masses are tufaceous I may call them *cargneule*. The schist adjoining is much decomposed, and I failed to obtain a good specimen of their contact. Associated was a carboniferous shale, and then the schist became more compact. Above this again, but out of my reach, seemed a further mass of tufa, and there was a curious cavern where I saw traces of a fox decidedly *recent*, and a few feathers of the domestic fowl! These lower strata dipped at angles of from 10° to 15° N.W."

On the same—the W. side of the valley—but near the foot of the great Zinal glacier, in the precipices, are to be seen indications of copper minerals, and on ascending the *débris* and climbing the rocks I found a short level of 7 to 10 yards had been driven into rock rich in quartz, but beyond a little very poor pyrites and some silicates there was nothing to be found. Quartz and calc spar were the chief minerals, and the rocks were not easy to refer to a distinct class, but seemed to me schistose and to be very close to a junction with Lory's "*schiste lustré*."

The lode, if it be worthy to be called one, dipped 12° S.W., and I subsequently found traces of similar lodes in the all but inaccessible west flanks of Lo Besso, on the opposite side of the valley, occurring at such an additional elevation as to seem to have the same amount and direction of dip. Again, in the Grimenz Thal which bifurcates from the Val d'Anniviers, nearly opposite Vissoie are mines at a height which I imagine, from what I have been told, to correspond to about the same dip; but I have not personally verified this. The mines at La Barme also may be about the same zone. Those above Ayer appeared to me higher up, but these are points to be cleared up on another occasion, weather permitting. Or, on a visit to Berne, I may be able to obtain the correct levels from the topographical department. I believe none of the mines are now being worked. The various ores contain Lead, Nickel, Cobalt, Arsenic, Bismuth, Copper, and Hematite. I believe none of the mines are being worked, but I was told that a law suit is pending as to those in the Grimenz valley, which is very likely a more profitable thing to some concerned than most mining.

With regard to the rocks surrounding the great Zinal or Durand glacier, the points at which I have been able to inspect them for myself are:—the steep mass on the W. forming the buttresses of the Pigne de l'Allée and the Bouquetin, the precipices of the Trift Joch, the Pointe de Mountets, the Mountets themselves, the lower rocks of Lo Besso, and, below the

glacier, the Pointe d'Arpitetta, and right in the middle of the ice basin the Roc Noir, a magnificent point of view. To generalize, I may say, I believe the whole to consist of talcose rock, more or less legitimately to be called gneiss, and the whole of this gigantic mass dips away towards S. and S. W. Below the glacier the rocks consist of chloritic and epidotic schists for some distance. Then we enter upon the schistes lustrés, and, at Zinal, on the right bank of the Navigenze, is a patch of protogine (?)

Let me sum up the cargneule question. In a climb W. of Zinal we cross successively the following rocks, numbered according to Gerlach's tabulation of their age, not in the order met with :—(1) older talc schist, a little quartzose rock, then (3) dolomite and cargneule, then (4) schiste lustré, and then (2) chloritic schist. Is this identical with the cargneule which Renevier places *under* the Rhœtic beds, which again he places at the bottom of the Lias? If so, can the schistes lustrés be triassic, and was there such a geological period between the dolomitic and Rhœtic beds as this must have required? The weak point of my evidence is my failure to make out the relations of the cargneule, &c., with the schiste lustré. I hope this summer some one will take this in hand; and to all climbers I say—do not trust that blessed tufa!

A week might be profitably spent as follows :—First afternoon ascend from Sierre to St. Luc, where sleep. Early next morning ascend the Bella Tola, descending to Vissoie, on the way making détours to inspect the workings of the "old men." Next day go up the Grimenz Thal and ascend the Becs de Bossons, or some point on that side the Grimenz Thal, (M. Monnet's advice can well be taken, or that of Jean Martin, the guide), and return to Vissoie. Next day go a short distance up the Grimenz Thal and climb that side of the pointe de Sorrebois so as to inspect the mines and also the occurrence of gypsum, descending to Zinal. Another day ascend to the Roc de la Vache, and descend to the châlets of Arpitetta, whence continue to les Mountets, to which provisions, fuel and wraps must be sent. From the Alpine Club cabane there, it is worth while next day to ascend the Roc Noir, unless there be an intention to cross one of the high passes to Zermatt, which is a mountaineering trip and thoroughly worth the while. If any more time is available, instead of ascending from the Arpitetta to Mountet, return, crossing the glacier to Zinal; next day explore my tufa, and at mid-day ascend to Mountet to sleep. With these and other excursions a fortnight could be well occupied in and about these valleys, independently of rests.