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Switzerland from underneath: the Alps are 4 kilometres high – and 60 kilometres deep

Petrified white horses in a tremendous surge from Africa

At 15,203 feet, Dufour Peak in Valais is the highest point of our Alps. But how far underground go the roots of the mountains? Geologists have finally got the answer: the Alpine foundations are 60 kilometres deep. Seen in this way, the proud ice caps are nothing more than the crests of a gigantic wave made up of heaps of stone piled high on top of one another.

On his head a weather-proof felt cap, in his hand a hammer, in his rucksack sausage and bread squashed between kilos of rocks, his bed in the hay of a mountain hut or simply under the stars – that is the picture of an Alpine geologist any time between 1800 and 1950. «Mente et malleo» – with

mountains like the Alps had an extremely complicated inner structure and that nature had not been over-generous in endowing Switzerland with mineral wealth.

The few mines in Switzerland merely scratched the mountain's surface. The

railway tunnels of record length went right through the Alps, it is true, but they did not touch their foundations. Their roots remained unobserved by man, and important questions about their structure were left unanswered. Until about 40 years ago, that is, when geophysics came to the rescue. Since then, dynamite and vibrators have become important aids to the work of the geologist's hammer. Sound-waves penetrated deep into the underground, were thrown back by layers of rock and were picked up seconds later as echoes at the earth's surface.

"Echo from the underground"

The results of the national research programme, "Switzerland's Underground Geological Structure", may be found as a contribution to Swiss "vertical local history" in the form of a richly illustrated and easily comprehensible brochure in German, French and Italian. This 30-page document may be obtained free of charge from the Swiss National Fund, Department IV, P.O. Box, CH-3001 Berne. Multiple orders for schools, museums, associations, etc. are possible.

From North Cape to Tunis

In recent times, such geophysical research methods have extended our knowledge about Europe's structure significantly. A 4,000 kilometre line from North Cape to Tunis, known as the European Geotraverse, has been thoroughly examined in a joint project spanning the whole continent. In the nature of things, the Alps are a key area along the line. This means that parts of Swiss territory are of particular importance. The Swiss contribution is called "Switzerland's Underground Geological Structure". It is a national research programme (NFP 20) sponsored by the Swiss National Fund for the Promotion

of Scientific Research. Work began in 1985 and is now complete. The cost was Sfr. 14.5 million.

In order to cover the whole country, geologists and geophysicists did not limit themselves to the actual line but selected several traverses with a total length of 700 kilometres. The most important result for natural science is felt to be the discovery that the structure of the visible Alps as established by the

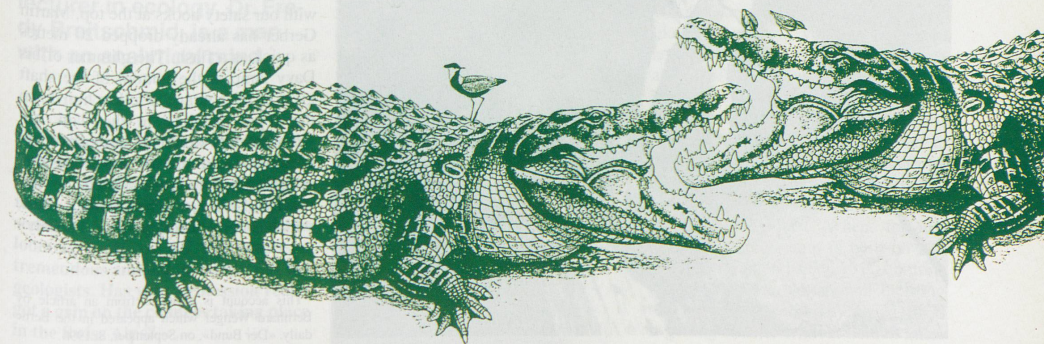
earlier field work continues underground. The roots of the Alps extend to a depth of 60 kilometres! And – the Matterhorn comes from Africa!

Valais under water

In addition to the new knowledge about the underground structure and mountain formation of Switzerland, the NFP 20 research work brought out interesting regional information. An example comes from the Rhone valley between Sion and Martigny. Here in central Valais the flat surface of the inner Alpine longitudinal valley is made up of

young friable stone, or rubble. Where today orchards and industry flourish and important transport routes pass, at the end of the last ice age there was a lake, both long and deep. The main surprise was the distance of the rock below ground level in this central Rhone valley. Above Martigny the bottom of the lake was about 3,000 feet below the valley surface of today! ■

The thrusts of the southern and central Alps were like two crocodiles fighting, with jaws interlocked.



Franz Auf der Maur

head and hammer – was the motto of this nature boy (there were no girl geologists in those days). In spite of limited means, such men collected large amounts of knowledge on their note pads, known as field books: they put down all their observations about the distribution, age and origin of the various types of rock; they discovered that it was not volcanic force but overthrusts in the earth's crust through pressure from the south which threw up the Alps; they came to realise that