

Zeitschrift: Schweizerische mineralogische und petrographische Mitteilungen =
Bulletin suisse de minéralogie et pétrographie

Band: 59 (1979)

Heft: 1-2

Artikel: A new geomagnetic survey and geoelectric soundings in Switzerland

Autor: Fischer, G. / Schnegg, P.-A.

DOI: <https://doi.org/10.5169/seals-46058>

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

Terms of use

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

Download PDF: 13.03.2026

ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>

A New Geomagnetic Survey and Geoelectric Soundings in Switzerland

Report by *G. Fischer** and *P.-A. Schnegg**

By coincidence the research effort in geomagnetism at the Observatoire Cantonal of Neuchâtel was started at the onset of the IGP (International Geodynamics Project), in 1971. The Working Group set itself essentially two goals: (1) to carry out a new geomagnetic survey of Switzerland, and (2) to initiate a programme of geoelectric soundings by the magnetotelluric and inductive techniques, in order to participate in a joint survey of the ground resistivities of the country planned by various institutions for the period 1980–1985, each using different means.

The first assignment has been carried to conclusion during the IGP, even though some geomagnetic survey work will continue after the IGP, with the aim of studying particular anomalies in more detail and of following secular variation. The survey was carried out with the help of a new vector magnetometer¹, specifically designed and built for that task, which greatly facilitated and speeded up the work. About 450 sites have been surveyed in four seasons (1974–1977), in and around Switzerland, to insure a good overlap with the country's neighbours. Detailed maps of the elements D, I, F, H, and Z have been produced, as well as of the anomalies of D, I, and F². As an example, Fig. 1 reproduces our map of amplitude anomalies ΔF . Concurrently with the survey a new geomagnetic reference station has been established near Neuchâtel, to replace the Regensberg Observatory which ceased all operations in 1975. A detailed English description of the survey³ as well as a shorter French version⁴ can be obtained from the authors of this report.

The second assignment of initiating a programme of geoelectric soundings has also been completed, at least as concerns the setting up of the equipment, and preliminary soundings have been carried out since the autumn of 1977. Our instrumentation covers the spectral range from periods of a millisecond to 3000 seconds in two separate bands. Data handling in the field is entirely digital and microprocessor-controlled⁵. Part of the data is processed on-line in the field to

* Observatoire Cantonal, CH-2000 Neuchâtel (Switzerland)

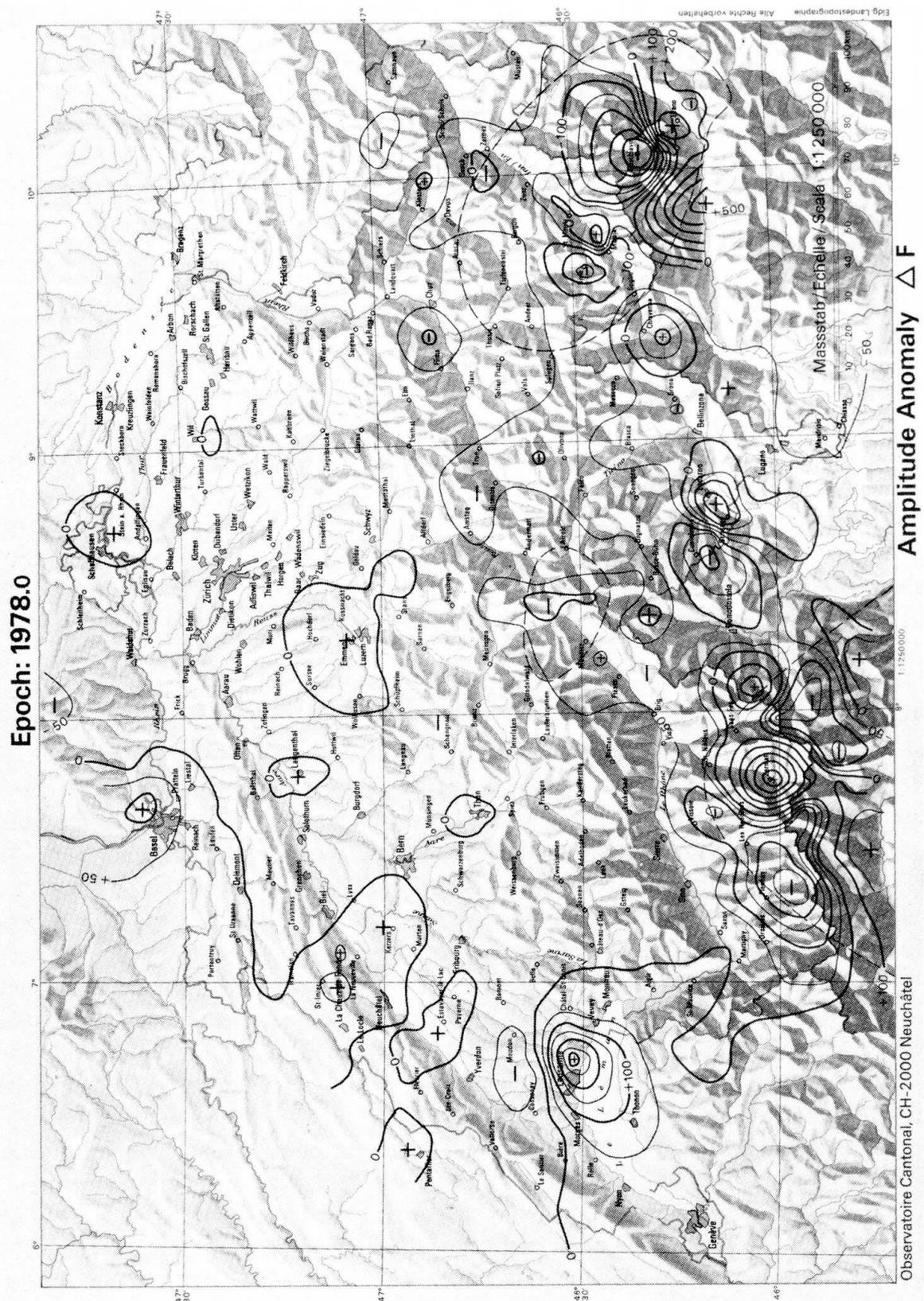


Fig. 1 Map of amplitude or total intensity anomalies, $\Delta F = F - F_{\text{normal}}$. The normal field, expressed in nT or gammas, satisfies the simple equation $F_{\text{normal}} = 46\,732.5 + 2.8(x - 200) + 0.3(y - 600)$, where x and y are the Swiss military kilometric coordinates. In this map we note that excepting the Jorat anomaly around Lausanne, all the strong anomalies are on the southern reaches of the Alps. This suggests that the Jorat anomaly is not connected with the formation of the Alps and probably predates that event.

yield provisional apparent resistivity curves as the sounding proceeds. This allows the sounding crew to decide whether a sounding has been successful and to take decisions regarding the pursuit of the survey. The digital data handling has made it possible to use digital filtering and windowing, which were found almost indispensable to overcome the very strong perturbations caused in Switzerland by the electric railways ($16\frac{2}{3}$ Hz and odd harmonics) and the mains (50 Hz and odd harmonics).

The experimental sounding work was conducted in parallel with some theoretical studies. One project was aimed at clarifying the properties of symmetry of the surface impedance tensor in the case of structures with a vertical plane of reflection symmetry⁶. Another project involved the study of an ocean coast model under E-polarization induction⁷⁻⁹. The model investigated consists of a uniform substratum partly shielded by a perfectly conducting, infinitely thin half-plane, the edge of which represents an abrupt ocean coast. This induction problem was for the most part solved analytically; only the last step, the resolution of an integral equation, was carried out numerically. The results obtained are in good accord with the well-known geomagnetic ocean coast effects.

References

- 1) FISCHER, G.: An Inexpensive Portable Vector Magnetometer. Abstract No. SI-6, p. 247 of IAGA Bulletin No. 34: Program and Abstracts for the Second General Scientific Assembly, Kyoto (Japan), 1973. See also: Fischer, G.: Un magnétomètre vectoriel d'un nouveau type. *Zeitschrift für Angewandte Mathematik und Physik*, Vol. 26, p. 136 (1975).
- 2) Maps of the elements, D, I, and F, at a scale of 1:500000 and on a tectonic background, are available commercially in Switzerland. They can be purchased in bookstores. Orders from abroad can be handled by the authors of this report.
- 3) FISCHER, G., SCHNEGG, P.-A., and SESIANO, J.: A New Geomagnetic Survey of Switzerland. Report No. 19 of the "Contributions to the Geology of Switzerland - Geophysical Series" (1979).
- 4) FISCHER, G. and SCHNEGG, P.-A.: Le Nouveau Levé Géomagnétique de la Suisse. *Vermessung, Photogrammetrie, Kulturtechnik (Mensurations, Photogrammétrie, Génie Rural)*, No. 8-77, pp. 253-261 (1977). This paper has been reprinted with the authors' permission by the review *Géomètre*, July 1978 issue, pp. 14-23.
- 5) SCHNEGG, P.-A. and FISCHER, G.: On-Line Determination of Apparent Resistivities in Audio-Magnetotelluric (AMT) Soundings. Abstract and orally presented paper at the 39th Annual Meeting of the German Geophysical Society, Kiel, April 8-12 (1979).
- 6) FISCHER, G.: Symmetry Properties of the Surface Impedance Tensor for Structures with a Vertical Plane of Symmetry. *Geophys. Vol. 40*, pp. 1046-1050 (1975).
- 7) FISCHER, G., SCHNEGG, P.-A., and USADEL, K.D.: E-Polarization Induction in a Conducting Half-Space screened by a Perfectly Conducting Half-Plane. *Acta Geodaet. et Montanist. (Hungary)*, Vol. 12, pp. 247-253 (1977).
- 8) FISCHER, G., SCHNEGG, P.-A., and USADEL, K.D.: Electromagnetic Response of an Ocean Coast Model to E-Polarization Induction. *Geophys. J. Roy. Astron. Soc.*, Vol. 53, pp. 599-616 (1978).
- 9) FISCHER, G.: Electromagnetic Induction Effects at an Ocean Coast. *Proc. IEEE*, Vol. 67, pp. 1050-1060 (1979).

Manuscript received July 23, 1979