

Christian Doppler's attempt to investigate secular variation in the 19th century

Orientation has always been of importance in underground mining activities for several reasons such as construction purposes, to discover ore deposits, to follow the legal mining areas and for safety reasons. During medieval times the profession of mining surveyors evolved with the main duty to measure and map the mine precisely. The magnetic compass was of great use for the mine surveyors (Fig. 1) as it helped them to distinguish the cardinal points even underground. Christian Doppler first realized the importance of these records to investigate secular variation of the Earth's magnetic field. Declination values from old mining maps were compiled.

Already in the 12th century simple magnetic compasses were used for orientation in mines. First usage of magnetic compasses (Fig. 1) in the alpine mining areas is verified for the second half of the 15th century (Ludwig & Schmidtchen, 1997).

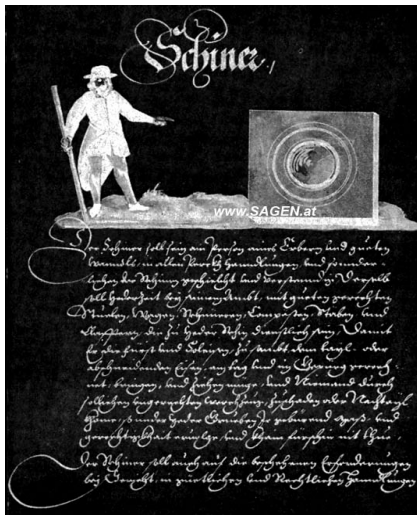


Figure 1: mine surveyors' compass (www.sagen.at).

In 1849, Christian Doppler indicated during a meeting of the "mathematisch – naturwissenschaftlichen Classe" of the k. & k. Academy of Sciences that mining maps and other records by mine surveyors could be a so far unused resource for historical declination measurements (Doppler, 1850). It was known that the magnetic compass had been an excellent tool for orientation, measuring and mapping purposes in underground mining activities. In an attempt to investigate secular variation of the geomagnetic field, Christian

Doppler requested declination values from the k. & k. mines, and in 1850 he compiled historic declination data from several mines of the former k. & k. Empire.

Time series of the compiled 97 declination measurements are shown in Fig. 2. The declinations values were gained by comparing old mining maps with newer ones. The declination values shown in Fig. 2 describe a westward drift until the 18th century. After 1800 the declinations values are in the order of -15° to -17° . The declination values of the mine Bockstein, which is geographically located further south, have a more easterly trend and adjust to the other declination values around 1840.

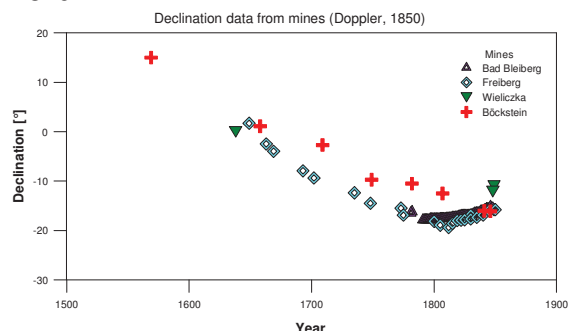


Figure 2: Declination data for the indicated locations from measurements in mines (Doppler, 1850), due to the close agreement several of the mine data are hardly distinguishable.

References:

- Doppler, C., 1850. Bemerkungen und Anträge, die Einsendungen magnetischer Beobachtungsdaten aus Joachimsthal, Freiberg, Pflibram, Leoben, Ischl, Salzburg betreffend. In: Sitzungsberichte der Mathematisch-Naturwissenschaftlichen Klasse der Kaiserlichen Akademie der Wissenschaften, 4, 72 pp.
- Ludwig, K.-H., Schmidtchen, V., 1997. Metalle und Macht 1000–1600. Propyläen Technikgeschichte, Berlin.

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