Kontinentales Tiefbohrprogramm der Bundesrepublik Deutschland
Geochemistry of Metabasites and Element Mobility

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Metabasites play an important role in several units of the E-Bavarian basement. A detailed classification of these metabasites, based on petrographic criteria as well as main-, trace-, and rare-earth-elements, can be very helpful for an identification of certain units in the KTB drill cores and may give new aspects for reconstructing the paleoenvironment of the tectonic units.

CLASSIFICATION:

The metabasites of the Zone Erbendorf-Vohenstrauß (ZEV) and the Erbendorf Greenschist Zone are different in their geochemical character (see Fig.1): Schistose and striped amphibolites of the ZEV are comparable with N-MORB compositions, flaser-amphibolites of the ZEV are similar to enriched E-MORB or ocean island basalts. Metagabbros of the ZEV with slightly enriched incompatible elements are transitional between both types. Metabasites of the Erbendorf Greenschist Zone can be compared with tholeiitic to calcalkaline island arc basalts (Oppermann et al., 1986; Schüßler, 1987; Schüßler et al., in press).

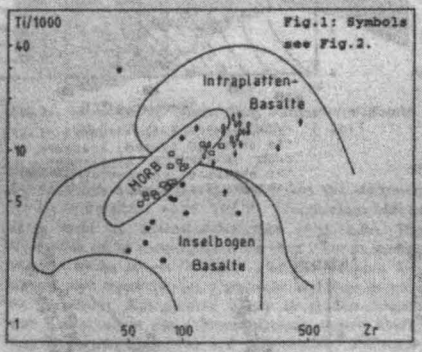


Fig.1: Symbols see Fig.2.

The regional distribution of these metabasitic main types from the KTB target area are mapped (see Fig.2). The flaser-amphibolites are dominating in the northern and middle part of the ZEV, whereas the schistose and striped amphibolites prevail in the south.

Amphibolites of the Zone Tirschenreuth-Mähring are N-MORB like in their geochemical character. Metabasites of the Fichtelgebirge crystalline complex can be compared with tholeiitic to alkaline within-plate or E-MOR basalts.

Prasinites of the Prasinit-Phyllit-Serie of the Münchberg nappe pile are similar to tholeiitic to calcalkaline island arc basalts and thus compare well with metabasites of the Erbendorf Greenschist Zone. The same holds true for amphibolites of the Hangendserie. However, there are no definite geochemical parallels between metabasites of the ZEV and any unit of the Münchberg nappe pile, although amphibolites of the Randamphibolit-Serie are tholeiitic in character, too.

ELEMENT MOBILITY:

In most of the investigated metabasites from the KTB target area, a postbasaltic mobilization of discriminating elements cannot be recognized. Thus, a conclusion on the tectonic setting of the basaltic protolith may be possible. In special cases, however, compelling evidence for mobile behaviour of certain trace- and rare-earth-elements was found:

(1) Element mobility and contact metamorphism:

Flaser-amphibolites of the northern ZEV near Windisch-Eschenbach underwent contact metamorphic overprint caused by the intrusion of the Variscan Falkenberg granite. Petrographically this event is documented by the formation of two kinds of post-regionalmetamorphic hornblendes, of a new, Ca-poor oligoclase beside a regional Ca-rich oligoclase/andesine, and sometimes of secondary biotite and chlorite. The KTB location is situated close to the petrographically visible contact aureole of Windisch-Eschenbach (see Fig.2). The overprinted flaser-amphibolites are markedly enriched in the granitophile elements Rb, Li, K, W. The K/Rb-ratios are clearly decreased. Ca and Sr are generally depleted. A depletion of Cr and Ni is most conspicuous. Moreover, the intrusion influenced the so-called "immobile" trace-elements Nb, Ce, (P), Zr, Ti, V. They scatter in a much wider range than in the unaffected flaser-amphibolites, although with no clear tendency for enrichment or depletion (see Fig.3).

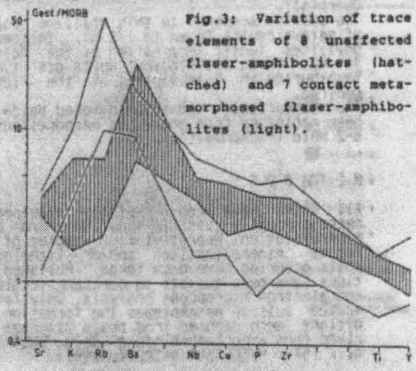


Fig.3: Variation of trace elements of 8 unaffected flaser-amphibolites (hatched) and 7 contact metamorphosed flaser-amphibolites (light).

(2) Mobilization of P and the lanthanides:

The schistose and striped amphibolites of the ZEV show a wide range of more ore less depleted light rare-earth-element- (LREE) and P-contents. Judging from a good correlation between P and the LREE (see Fig.4), this depletion should be due to the same fractionating process. Such a process must involve apatite, the only phosphate mineral of these metabasites, as apatite contains a large proportion of LREE in the whole rock, especially in rocks of basic compositions. Although we cannot completely exclude fractionation of apatite during an early stage of crystallization of the basaltic protolith, we have good reasons to believe that the depletion of P and the LREE was caused by decomposition of apatite and a transport of its chemical constituents by circulating fluids during postbasaltic alteration processes (see Schüßler, 1987; Schüßler et al., in press). There are indications, that the alteration is related to a young, post granitic hydrothermal mineralization found by Richter & Stettner (1987). It should be noted that a similar mobilization of P and the LREE was found in flaser-amphibolites from the region of Windisch-Eschenbach (see Fig.4).

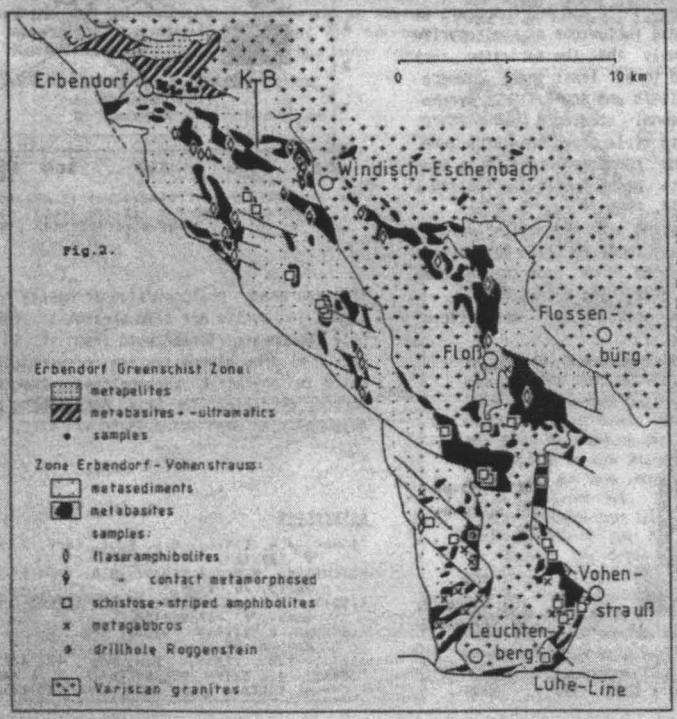
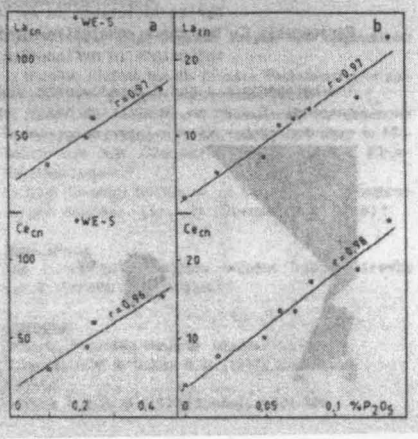


Fig.2.



right: Fig.4:
La and Ce vs. P2O5.
a: Flaser-amphibolites near Windisch-Eschenb.
b: Schistose and striped amphibolites.

Literature:
Oppermann et al.,1986: 2. KTB-Kolloquium, Seeheim/Odenwald, Posterprogramm, p.11.
Richter, P. & Stettner, G., 1987: Geol. Jb., D 86: 3-31.
Schüßler, U., 1987: Diss. Univ. Würzburg.
Schüßler et al., in press: Tectonophysics.