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GEOCHEMICAL INVESTIGATION OF PYROXENES FROM LOWER CRETACEOUS VOLCANICS FROM BOREHOLES OF THE GREAT HUNGARIAN PLAIN

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ABSTRACT

Originally the lower cretaceous volcanics known from boreholes of the Great Hungarian Plain proved to be feldspar-rich basaltic rocks. They are highly altered volcanics (Mg-metasomatism, spilitisation, weathering), and they contain as fresh component parts some grains of clinopyroxene. From electronmicroprobe analysis-data of the minerals is shown, that the pyroxenes are of diopside-salit-augite composition. It can be stated, that the analised grains refer to alcali magma, therefore the high alcalic content in the rocks is a result not only of metasomatism and contamination. The pyroxene analitical data supported the conception of rock-origin, that they are products of continental within-plate volcanism.

INTRODUCTION

The Lower cretaceous volcanics known from boreholes in the Great Hungarian Plain were originally felspar-rich basalts (SZEPESHÁZI 1960, 1977; MOLNÁR 1985). These rocks become highly altered (Mg-metasomatism, spilitization, weathering), thus only approximate conclusion could be drawn so far concerning the formation conditions the origin of magma.

In order to obtain more exact information, the chemical analyses of clinopyroxenes of these rocks were carried out. Measurements were made in microprobe of Satesa CAMEBAX type, under the following conditions: 15 kV accelerating voltage, 30 nA beam current and 10 s exposition time.

The standards below were used: diopside (Si, Mg, Ca, Al, Fe), albite (Na), and $MnTiO_3$ (Mn, Ti). The calculations of the ZAF correction was made by the computer of PDP 1123 type.

In the available 128 rock samples only three provided fresh pyroxenes. The grain diameters varied between 0,5 and 1 mm, this fact also limited the number of measurements.

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INTERPRETATION OF MEASUREMENT DATA

In the minerals the Ca-quantities can be considered to be standard, the percentual ratio of CaO varied between 18 and 22 %.

The iron and magnesium contens showed less uninform values. This is coused by the fact that paralell with the prograding differentiation the ferro-iron enters the cristal lattice in ever greater amounts, instead of Mg. The lower iron content was measured in the cores of the mineral grains. This difference could not be identified under microscope, i.e. the minerals did not display sector zoning.

The composition of clinopyroxenes varied between $Ca_{45}Mg_{48}Fe_8$ and $Ca_{40}Mg_{39}Fe_{21}$ extreme values, i.e. are of diopside-augite-salite composition. In most cases these can be qualified as augites of relatively high Ca-contens (*Fig. 1*).

The TiO_2 contens were lower than expected. The average TiO_2 content proved to be 1,46 % in the mineral grains. This was rather asthonishing since in harmony with the chemical analyses of the rocks the average TiO_2 content is 3 %, sometimes values of about 5% also occurred. Consequently, titanium is enriched first of all in rutile and leukoxene that were identified under microscope, as well.

The sodium content is low, i.e. 0,4 %, some enrichment towards the rims of grains can be observed.

The studied grains contained 0,2 Mn, on the average.

The $\frac{Fe+Mn}{Fe+Mn+Mg}$ differentiation index varies between 0,1 and 0,3. This values were plotted as a function of the Ti and Al contents. It is known from the literature that parallel with prograding differentiation the Al and Ti contents that enter the crystal lattice increase and this fact is proved also by my measurements on pyroxenes of the samples studied.

It is more remarkable, hovewer, that the projection points are grouped within a narrow interval, this fact indicating a magma of low degree of differentiation (*Figs. 2* and *3*), or a phenomenon that only certain type was resistant to epigenesis or other effects.

Based on the data obtained during these investigation an attemt was made to determine the magma type and the tectonic position of the formation itself. First I used the method of LETTERIER (1982, see *Fig. 4.*). It seems, that most of the points fall to the alcali field. In the course of interpreting the main element analyses of the rocks it proved to be to be a serious problem to decide this question, moreower no exact answer could be given.

Nevertheless, these data serve as a reliable basis for the subsequent investigations based first of all on the inmobile trace elements.

To decide to the tectonic setting the discrimination method of NISBET-PEARCE (1977) was used. Trough this method has some veak points., i. e. separability is not always unambiguous and is based on the Na-, and Mn-values that fluctuate usually around the detection limit, it is remarkable, that practically without some exception the projection points fall to the within-plate alcali field, and this supports the statement based on the previous method.

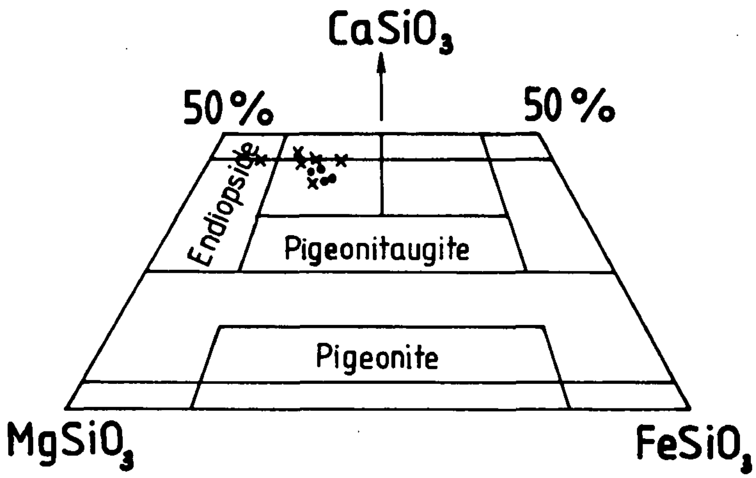

Fig. 1. Clinopyroxene compositions (after POLDERVAART and HESS, 1953).

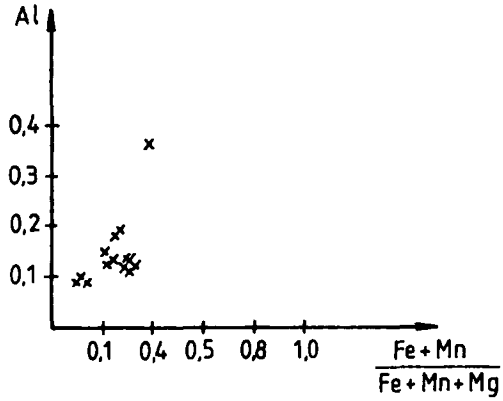

Fig. 2. The $\frac{Fe+Mn}{Fe+Mn+Mg}$ - Ti diagram

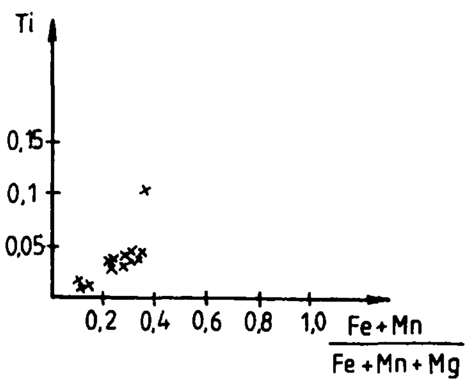

Fig. 3. The $\frac{Fe+Mn}{Fe+Mn+Mg}$ - Al diagram

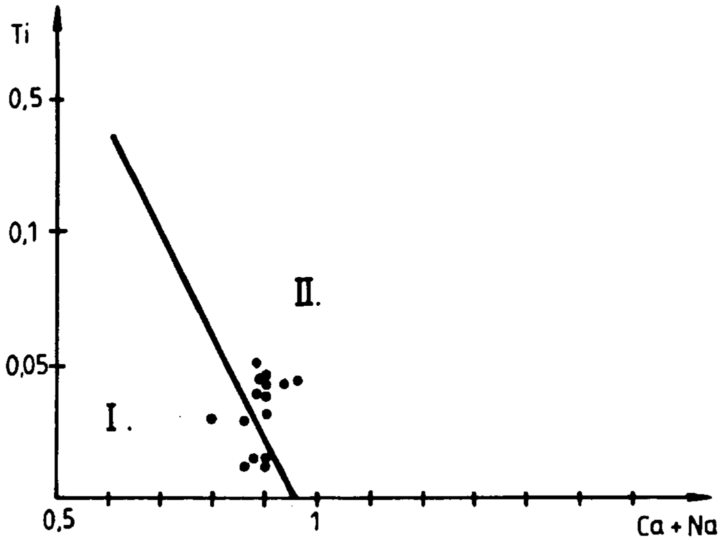

Fig. 4. The Ti-Na-Ca diagram (after LETTERIER et al. 1982).
I. Tholeiit field
II.Alcali field

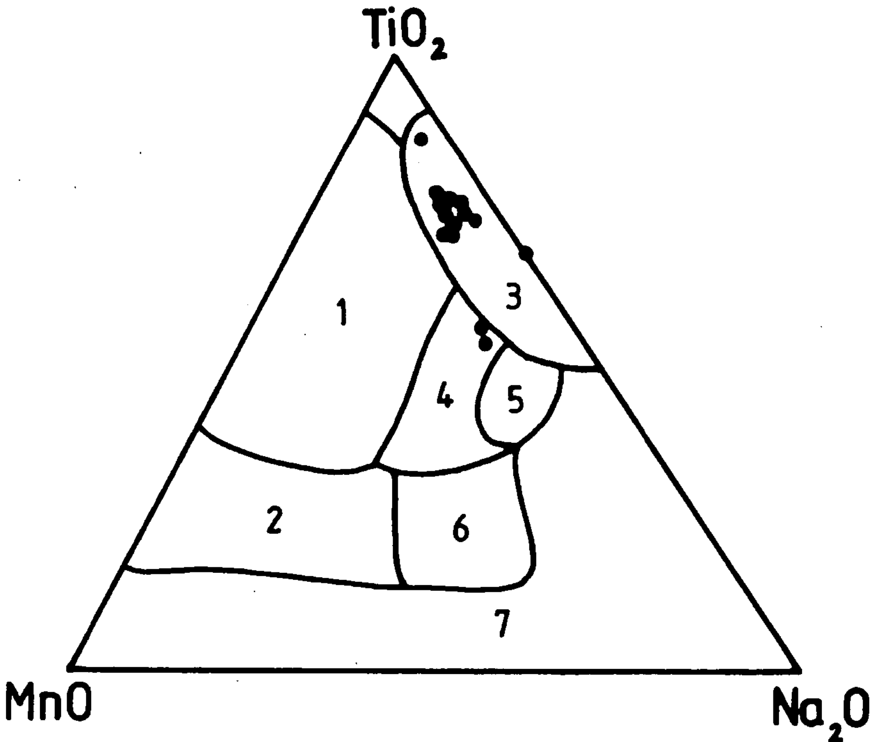

Fig. 5. The MnO-Na_2O-TiO_2 diagram (after NISBET and PEARCE, 1977).

CONCLUSIONS

1. The clinopyroxenes of the Lower Cretaceous volcanics of the Great Plain are of diopside-augite-salite composition.

2. The original magma was less differentiated, this is reflected by the Ti-contens, by the differentiation index and by former results.

3. Based on the chemical studies of pyroxene phenocrysts it can be stated that the mineral grains refer to alkali magma, that is proved by the discriminating method, too and this fact does not contradict to the statements based on main element analyses.

4. Consequently the high alkali content of the rocks is a result not only of Na-metasomatism and contamination.

5. Having interpreted the main element analyses (MOLNÁR, 1985) it was proved, that rock products of within-plate volcanism and this statement is supported by the pyroxene analytical data as well.

6. It is worthy of mention, that the pyroxene analytical data of Lower Cretaceous volcanics of the Great Plain display remarkable similarity to those Lower Cretaceous volcanics of the Mecsek Mountains (SW Hungary).

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