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PETROCHEMICAL CHARACTER OF THE LOWER CRETACEOUS VOLCANIC ROCKS OF THE GREAT HUNGARIAN PLAIN

S. MOLNÁR*

ABSTRACT

Originally the Lower Cretaceous volcanics of the Great Plain proved to be olivine-free, pyroxene-bearing and feldspar-rich basaltic rocks. The initial magma was of tholeiitic composition. The volcanics were erupted in seawater and subsequently spilitized and auto-metasomatized. At the Lower and Upper Cretaceous boundary the rocks were uplifted and endured epigenic alteration. Their genesis is related to an early Cretaceous rift formation.

INTRODUCTION

In the region of the Great Plain considerable volcanic activity was characteristic in the Lower Cretaceous producing fairly big amounts of basaltic rocks *(Fig. 1)*. The products of this volcanic activity were revealed by hydrocarbon exploratory wells along the Kiskörös—Ebes line in a strip of 20 to 30 km width and in a depth varying between 1100 and 3100 m. Only a few publications are found on these rocks; this work has aimed to give some investigation results about these rocks.

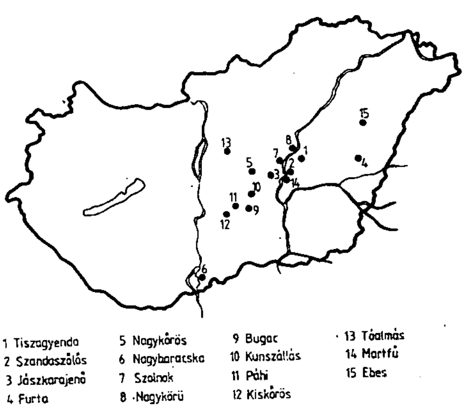

Fig. 1. The occurrence of the Lower Cretaceous volcanic rocks from hydrocarbon exploratory wells

* Department of Mineralogy, Geochemistry and Petrography Attila József University, H—6701 Szeged, Pf. 651, Hungary

ROCK TYPES OF THE LOWER CRETACEOUS VOLCANICS

Based on petrographic studies four groups of the rocks can be distinguished.

Spilitized lavas

The texture is micro-holocrystalline-porphyric, sometimes intersertal or porphyric-vitrophyric. Their main ingredients are feldspars of albite-oligoclase composition. The mafic minerals could be porphyric ingredients, their original quantity, however, might be also rather low. Recently mainly chlorite, occasionally their epidote pseudomorphs can be identified. It is conspicuous that olivine did not exist in the rocks, in their original state, as well.

Out of the auxiliary minerals leucoxene is important, apatite is subordinate.

Altered lavas

These rocks differ from the group above only in the fact that feldspars are also altered, mainly carbonatized and often transformed into clay minerals, occasionally epidotized.

Agglomerates

This types involves the pyroclastics. The clastic material does not differ from the rock types of the two foregoing groups.

Redeposited pyroclastics and volcanic alteration products

The mineral composition of these rocks could be identified only by means of X-ray and IR records. Except the low quartz content, the composition is similar to that of the groups above.

Originally, the rocks were basalts rich in feldspars and containing pyroxenes

PETROCHEMICAL CHARACTERIZATION OF THE ROCKS

Based on the results of 38 wet silicate analyses, the silica content of the rocks varies between 36 and 56%, the average being 43,5%. Out of the NIGGLI-values the average *si* amounts to −21.

The TiO_2 content is usually high, in some cases its amount exceeding 5%, as well. This is why in the thin sections so much leucoxenes are found.

The alumina content varies between 9 and 20 wt%. The occurrences of extremely high values are due to the posterior alterations.

The iron content was expressed in FeO. These values show dispersions similar to those of the alumina contents. The average proved to be 12%, this is below the value characteristic of the mafics. The low value of Fe_2O_3 of about 3% is remarkable referring to the reductive conditions of formation and alteration.

The MgO content of the rocks varies between 4 and 4.5%. This relatively low magnesium content is responsible for the fact that in this sections neither olivine nor some of its alteration product can be identified (e.g. serpentine). Magnesium is incorporated by chlorites and by the surprisingly frequent dolomite.

The average CaO content varies between 7 and 8%.

Table 1

Composition of rocks (diabases?) investigated

	1.	2.	3.	4.	5.	6.	7.
SiO_2	41.44	49.24	48.40	43.40	34.90	40.80	39.40
TiO_2	3.00	5.15	3.07	2.78	2.25	2.81	3.54
Al_2O_3	15.87	12.94	14.08	14.10	9.19	11.40	18.30
Fe_2O_3	2.08	3.17	2.54	2.69	5.69	5.56	3.26
FeO	13.22	7.32	8.72	9.21	1.89	3.20	2.94
MnO	0.10	0.15	0.25	0.19	0.27	0.13	0.10
MgO	7.66	7.86	4.56	8.15	2.59	5.36	1.85
Na_2O	4.56	4.00	3.62	3.21	0.76	3.04	1.86
K_2O	0.25	1.35	1.51	0.55	1.72	0.93	1.58
H_2O^+	0.53	0.63	2.74	4.78	4.32	4.47	6.23
H_2O^-	6.14	2.90	0.32	0.71	1.92	1.28	1.40
CO_2	1.23	0.89	0.73	1.18	14.10	7.67	8.73
P_2O_5	0.36	—	0.72	0.37	0.68	0.78	1.03
SO_3	0.17	—	—	—	0.26	0.33	0.21
BaO	—	—	—	—	0.26	0.33	0.21
Sum.	99.69	101.48	99.39	99.20	99.20	99.27	99.43

1. Öcsöd—2 2842—2847 m
2. Furta—4 2316—2320 m
3. Kecskemét—D—1 1401—1403 m
4. Ebes—1 1828—1830 m
5. Szandaszőlős—1 1931—1934 m
6. Szandaszőlős—1 1997—1998 m
7. Kaskantyú—1 1452—1454 m

The total amounts of the alkalies shows the characteristic values of mafics; nevertheless, the Na_2O quantity exceeds in some cases the 5%, the fact being explained by sodium metasomatism.

Some characteristic rock compositions can be seen in Table 1.

PETROGRAPHIC-PETROLOGIC QUALIFICATION OF THE ROCKS

It follows from the different instrumental (X-ray, IR, microscope) and chemical analyses that the ignous Cretaceous rocks of the Great Plain are volcanic products without exception (as to the available data, at least). The phenomenon of sodium metasomatism as well as the geological environment refer to submarine volcanism. The volcanics are mafic rocks, which originally were probably feldspar-rich basalts. This statemenet is supported by the plot of *Fig. 2.*

It is difficult to determine the character of the original magma. To decide this question one has more data available since no trace element data exist on these rocks. In spite of this some statements can be risked on the basis of main element concentrations, concerning the origin of the magma.

It has been successful to determine that the rocks were altered after their formation (seawater sodium metasomatism, autometasomatism, epigenic effects), thus only the plot could be used to the discrimination studies which do not take into account the most mobile elements. In spite of the high alkali content evidenced by the chemical analyses it can be probabilized that the original magma was of tholeiitic composition *(Figs 3* and *4).*

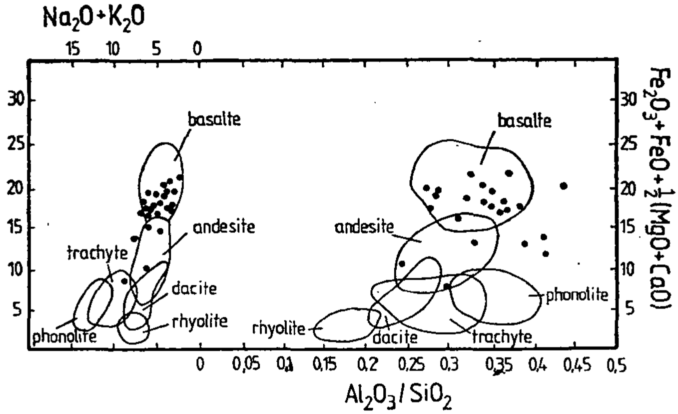

Fig. 2. The CHURCH-diagram (CHURCH, 1975)

Much more care should be applied when trying to decide the petrotectonic position, thus here only the PEARCE-plot is demonstrated *(Fig. 5)*. In this plot the points fall to the fields of continents and island arcs. In harmony with the results of thin section and analytical studies the rocks had to be generated in an enviroment where

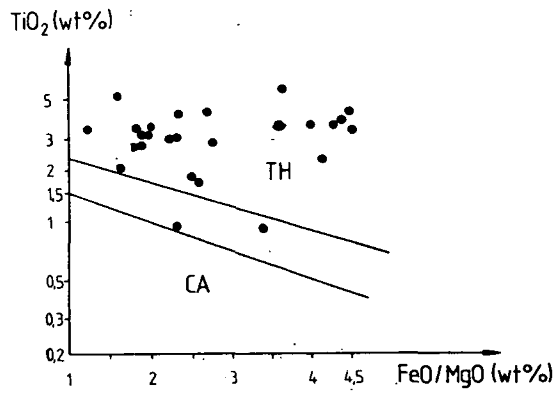

Fig. 3. The TiO_2—FeO/MgO diagram (MIYASHIRO—SHIDO, 1975)

the contamination of the originally tholeiitic magma by continental material could be possible. In the Lower Cretaceous, considerable rift formation should be most probably taken into account, this fact being supported by other geological evidences of the region (WEIN, 1978; BEÉR, 1983).

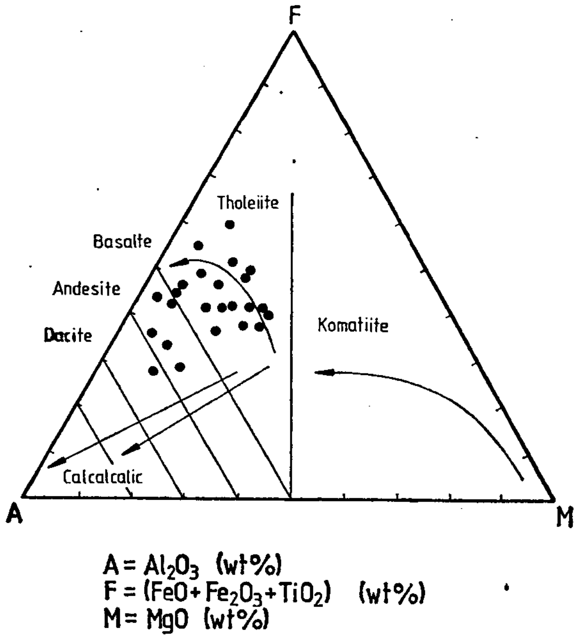

Fig. 4. The AFM diagram. (JENSEN, 1976)

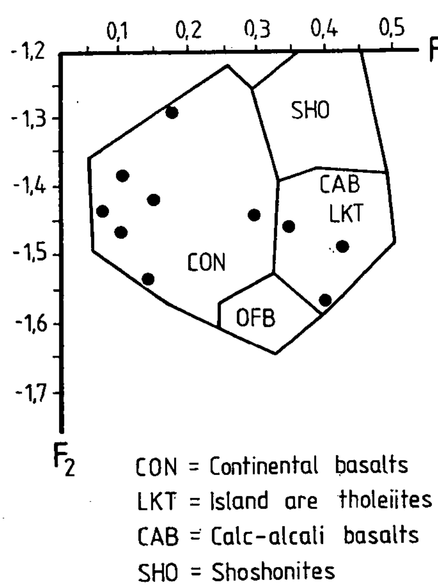

Fig. 5. The F_1—F_2 diagram (PEARCE, 1976)

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