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## **GEOLOGICAL AND PETROLOGICAL INVESTIGATIONS OF KIMBERLITES IN KANSAS, U.S.A. – PRELIMINARY RESULTS**

### **INTRODUCTION**

The geological and geophysical investigations of the rock complexes which occur within the Midcontinent Rift System, performed for many years by the United States Geological Survey, led to elucidation of many tectonic, stratigraphic, petrological and ore deposit problems of this huge structure of the length exceeding 1000 km, extending from the Lake Superior to the south-west and reaching the states of Iowa and Kansas. Almost whole rift system is filled up by clastic and volcanoclastic rocks (Barczuk 1992). Moreover, a minor component of the rift consists of lamproites (Cullers et al. 1996) and related rocks, e.g. kimberlites.

The discovery of the more than ten kimberlite pipes in the north-eastern part of the State of Kansas, the Riley and Marshall Counties, is one of the most interesting results of this large prospecting project. The kimberlites are of Cretaceous age (ca. 90 Ma BP). Two of the pipes named Antioch and Tuttle were the objects of the pilot investigations as the representatives of the whole group.

This report presents a preliminary results of the petrological studies of those kimberlites performed till now.

### **SAMPLES AND METHODS**

The samples were collected from cored and non-cored drillings. The microscope analysis was the main investigating method applied to 50 thin sections and polished preparations. The latter were used as well for the WDS analysis of chemical compositions of performed by means of the electron microprobe Cameca sx100 in the Inter-Institute Laboratory of Microanalysis of Minerals and Synthetic Substances at the Faculty of Geology of the Warsaw.

### **RESULTS**

The microscope studies of the kimberlites of the Tuttle and Antioch pipes revealed their two textural varieties. The pseudodetrital (pseudoconglomeratic) variety of inequigranular texture is most common. It contains abundant kimberlite xenoliths, various phenocrysts as well as country rock xenoliths (Fig. 1). Kimberlite xenoliths are pelletal lapilli that represent magma droplets typically composed of

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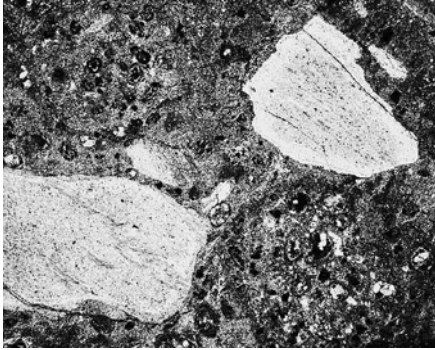


Fig. 1. Kimberlite and country rock xenoliths in fine-crystalline serpentine groundmass, upper right xenolith is actually 3 mm long; sample A-7, crossed nicols.

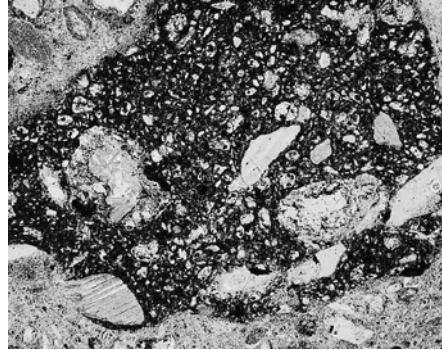


Fig. 2. Dark-coloured micaceous xenolith with phlogopite crystals; the horizontal side of the picture is actually 7 mm long, sample T-6, crossed nicols.

a thin selvage of kimberlite material surrounding a cognate or exotic clasts (sensu Field, Scott-Smith 1999). The rock can be referred to as an autolithic kimberlite (Dawson 1980) and typically occurs in the diatreme facies.

The second variety displays a more homogeneous, porphyritic texture and consists of a serpentine groundmass containing numerous small, highly altered phenocrysts. This type does not contain country rock xenoliths and only a few kimberlite xenoliths. The rock is typical of the hypabyssal facies (sensu Field, Scott-Smith 1999) in the relatively deep parts of the diatreme.

Phlogopite phenocrysts are common, though serpentine pseudomorphs after olivine are the main phenocrysts present, whilst chrome diopside is least abundant among them. Numerous dark-coloured lamprophyre-type (micaceous) xenoliths (Fig. 2) as well as less abundant peridotite–dunite kimberlite xenoliths are the essential components.

Preliminary microprobe analysis showed garnet from the Tuttle Creek kimberlite to be pyrope, typically with kelyphitic rims consisting of phyllosilicates and spinel. An unidentified (mica-like) mineral having a high barium content (up to 20 wt. % BaO) also has been found. Many of the idiomorphic crystals of opaque minerals are ilmenite, the balance are mainly Ti-Fe spinels.

Modelling of the magnetic anomalies (unpublished data, courtesy Pieter Berendsen 2002) shows that final emplacement of the kimberlite bodies was controlled by N40°W trending structures, rather than NNE-trending structures and that the contacts between the sides of the kimberlite bodies and the Paleozoic country rock are steeply dipping. Petrological studies show that the kimberlites consolidated under the conditions of the crater and diatreme facies in Riley County and hypabyssal facies in Marshall County.

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