OCCURRENCE of SILLIMANITE

in

FAYETTE COUNTY

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Environmental Protection Division
Georgia Geologic Survey

GEOLOGIC REPORT 4

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INTRODUCTION

Sillimanite, Al_2SiO_5, belongs to the aluminum silicate group of minerals which also includes kyanite and andalusite. If subjected to high temperature, these minerals form mullite. Mullite has such properties as high refractoriness, resistance to thermal shock, high resistance to deformation under load, resistance to attack by acids and high electrical resistivity at elevated temperatures. Such properties make it especially attractive in the manufacture of super-duty refractories, refractory cements and chemical and electrical porcelains (Wilson, 1952). One advantage of sillimanite over kyanite is in the conversion to mullite. Sillimanite has little or no volume change, whereas kyanite undergoes a volume change. Such properties allow the sillimanite to form a dense super-duty refractory (Hunter and White, 1946).

Occurrences of kyanite and sillimanite in Georgia have been described by Furcron (1945), Hudson (1946), Wilson (1952), Grant (1958), Espenshade and Potter (1960). Cook (1978) summarizes the known sillimanite locations in Georgia.

The purpose of this report is to describe a new occurrence of sillimanite that may have potential as a source of aluminum silicate. Sillimanite occurs in thermally altered areas of mica schist in Fayette County that have been intruded by the Palmetto pluton. These areas have been named the Shake Rag and Tyrone Phase of the Palmetto pluton (Higgins and Atkins, 1981). This report is based on reconnaissance geologic mapping for the Greater Atlanta Region Map (U.S. Geol. Survey, 1974, scale 1:100,000) and is not intended to supplant site investigations by industry or consultants.

GEOLOGIC RELATIONS

Fayette County is in the Piedmont Province of Georgia, about 56 kilometers (35 miles) southwest of Atlanta (Fig. 1). The area has been polydeformed and intruded by a post-metamorphic pluton (Atkins and Higgins, 1978 and

1980). The Palmetto pluton is structurally controlled because it occupies the apical area of a northwest trending cross fold in the Peachtree area (Atkins, et al, 1981). Near Peachtree City, the Palmetto contains numerous xenoliths and is associated with large areas of altered rock. These areas have been named the Shake Rag and Tyrone Phase of the Palmetto Granite (Fig. 2: Higgins and Atkins, 1981). The Shake Rag consists of a quartz-sillimanite rock, sillimanite schist, and sillimanite gneiss. The Tyrone contains practically equal percentages of granite and altered country rock.

Figure 1. Location map of the study area

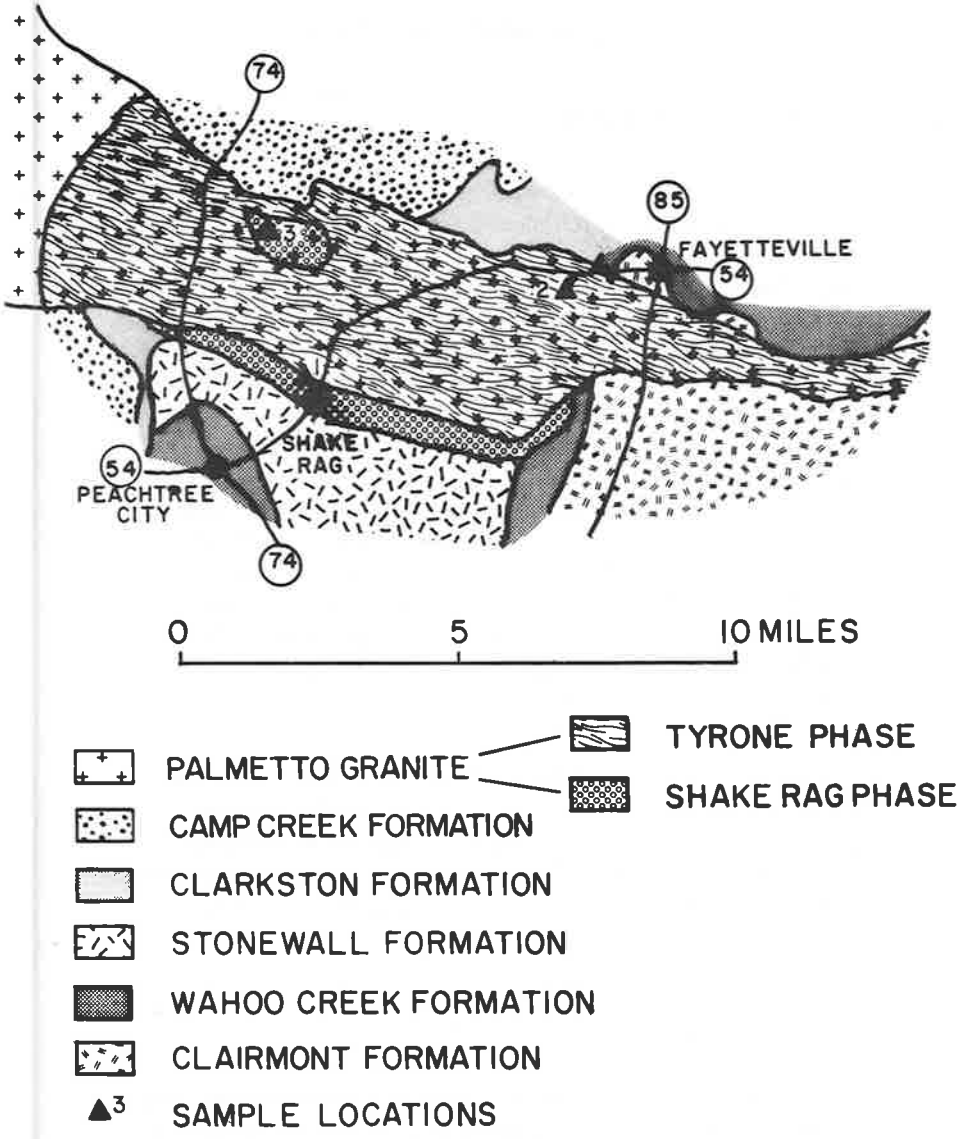

Figure 2. Geologic map of a portion of Fayette County near Peachtree City.

ECONOMIC POTENTIAL

Petrology and Chemistry

In hand specimens, sillimanite occurs in a quartz-sillimanite rock, sillimanite mica schist and sillimanite gneiss. These rocks are interlayered on meter scale with granite, gneiss and amphibolite. In thin sections of random grab samples, the sillimanite varies from 0-13% (volume) in the Shake Rag and from 0-73% in the Tyrone Phase. Typically, the texture is gneissic composed of thin (millimeter scale) alternating layers of quartz and sillimanite. The quartz layers are slightly coarser than the sillimanite layers. In some samples, the sillimanite has a nematoblastic schistosity due to its occurrence in a needle-form and probably is the result of regional metamorphism. Sillimanite, also, occurs as a result of thermal metamorphism and consists of radiating acicular crystals on quartz and muscovite. The length of these needles is on the millimeter scale. Muscovite forms less than 11% of the Shake Rag Phase. Thin sections of rocks with biotite usually contain no sillimanite.

Samples one (1) and three (3) are from the Shake Rag phase and sample number two (2) is from the Tyrone phase (Table 1). These samples are slightly weathered. The aluminum oxide content of the sillimanite-bearing rocks ranges from 12% to 24% and iron oxide from 1.2% to 2.7% (Table 1).

Transportation

The Family Lines railroad crosses the northwestern end of the Shake Rag. State road 54 and secondary roads make all sections of the Shake Rag accessible.

Table 1: Chemical analyses of sillimanite-bearing rocks in Fayette Co., Georgia.

Samples 1 and 3 are from the Shake Rag Phase and Sample 2 is from the Tyrone Phase (see Figure 2).

	SAMPLE NUMBER		
WEIGHT %	1	2	3
SiO_2	80.60	66.80	77.46
Al_2O_3	12.80	24.70	14.60
Fe_2O_3	1.20	1.30	2.70
TiO_2	0.10	0.10	0.05
CaO	0.20	0.20	0.10
MgO	0.00	0.06	0.15
K_2O	2.80	2.70	1.40
Na_2O	0.42	1.25	0.20
MnO	0.01	0.03	0.01
P_2O_5	0.00	0.00	0.00
H_2O	1.78	2.80	3.30
Total	99.91	99.94	99.97

CONCLUSIONS

Although sillimanite may comprise 13% of the Shake Rag and up to 73% in the Tyrone Phase of an individual layer, these zones are interlayered with rocks containing little or no sillimanite which will have to be removed during mining. Determination of the size of the sillimanite-rich body, its thickness, and tonnage of sillimanite are not reported here as they are beyond the scope of this report. A detailed site study which includes a drilling program to outline sillimanite areas and provide samples for additional petrologic and chemical analyses would be necessary to determine the quality and quantity of sillimanite.

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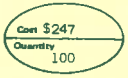

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