THE HILLABEE VOLCANIC COMPLEX, SOUTHERN APPALACHIANS: RADIOGENIC Pb-Pb AGES OF ZIRCONS

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Introduction

Rocks of the Hillabee Greenstone comprise the largest unit of meta-volcanic rocks in the western Blue Ridge. These are largely meta-basalts, but silica rich units of meta-dacite make up approximately 20 % of the exposed complex. Some of the meta-dacite sheets cover an area of more than 300 km2. Such an aerial extents implies large explosive eruptions, and if such individual sheets represent single eruptions, then these eruptions rivaled in size that of the 1883 eruption of Krakatua. In 1978 Gail Russell reported U-Pb ages of zircons from a Hillabee metadacite of 460 million years. Each of the four samples analyzed by Russell consisted of a few hundred small (approximately 100-200 microns in length) crystals of zircons.

The time of eruption reported by Russell has been challenged on the basis of field evidence that seems to indicate that the Hillabee volcanics stratigraphically overlie metasediments containing fossils of Devonian age (< 395 m.y.). It was suggested that the Hillabee metadacites contain mixed populations of zircons: one population being inherited for the 1100 m.y. old continental basement rock form which the magmas originated, and the other population crystallizing from the Hillabee magma just prior to eruption less than 390 million years ago. If the Ordovician age of the Hillabee rocks is correct, significant rethinking of current tectonic models of the Southern Appalachians seems required.

Experimental

In order to distinguish between the conflicting interpretations, we have made a search for the postulated, older component. Fifty-four individual zircon crystals have been analyzed for their Pb isotopic composition, by a technique combining laser ablation and an inductively coupled plasma mass spectrometry. The "age" T can be determined from the relation $^{206}Pb/^{207}Pb = 137.8\ (e^{\lambda 238T}-1)/(e^{\lambda 235T}-1)$. Here λ238 and λ235 are the decay constants of ^{238}U and ^{235}U, and137.8 is the atom ratio $^{238}U/^{235}U$.

Results and Discussion

The data obtained yield an Ordovician age of 498 +/- 15 m.y. (about 5% older than the previously reported age) and show no indication of a mixed population of old (1100 m.y.) and younger (<390 m.y.) zircons. If fossils in the strata underlying the metavolcanics have been accurately identified as Devonian in age, then a large, unrecognized, and rather unusual fault must separate the Hillabee from the younger strata beneath.