TESTING THE APPLICABILITY OF THE PLAGIOCLASE AND TWO-PYROXENE GEOTHERMOMETERS IN GUARENA, A H6 CHONDRITE. V. P. Slater and H. Y. McSween, Jr., Department of Geological Sciences, University of Tennessee, Knoxville, TN 37996-1410.

Introduction

Estimating peak temperatures experienced by ordinary chondrites during thermal metamorphism is problematic because ortho- and clino.pyroxenes appear to record different temperatures. Temperatures estimated using clino.pyroxenes are consistently 100-200°C higher than orthopyroxenes in LL chondrites [1]. McSween and Patchen (1989) suggested clinopyroxene temperatures were better estimates because orthopyroxenes may have equilibrated faster during cooling. However, temperatures estimated in H6, L6, and LL6 chondrites using a plagioclase geothermometer, which is based on the ordering of Si and Al and does not rely on cation diffusion rates, correlate better with orthopyroxene estimates in L6 and LL6 chondrites [2]. Orthopyroxene data for H6 chondrites were not available for comparison.

The plagioclase thermometer assumes plagioclase crystallized through type 6 conditions, although the accepted classification scheme suggests complete feldspar crystallization by type 5 [3]. We tested this assumption by determining the modal abundances of minerals and glass in Guarena, an H6 chondrite, and comparing our result for plagioclase to the calculated normative abundance [4]. Modal abundances of minerals were determined using an electron microprobe equipped with the Featurescan microanalysis technique. We also performed pyroxene geothermometry and compared our results with those of [2] for H6 chondrites.

Results

Our result for modal plagioclase in Guarena of 9.3 wt.% agrees with the normative abundance of 9.4 wt.% [4]. K concentrates in glass during metamorphism so that a positive correlation exists between temperature and the Or content in plagioclase [2,5]. Therefore, any remaining glass not converted to plagioclase should be enriched in K. Our result for K-rich glass in Guarena is 0.01 wt. %, suggesting all glass has been converted to plagioclase.

We applied two two-pyroxene geothermometers [6,7] to estimate peak temperatures experienced by Guarena. The temperatures estimated for ortho- and clino.pyroxene are 800±50°C and 925±50°C, respectively. The temperature estimated using QUILF [7], which assumes both pyroxenes are in equilibrium, is 893±38°C.

Discussion

Our results confirm that clino.pyroxenes record higher temperatures than orthopyroxenes; however, our orthopyroxene temperature is slightly higher than the estimate from plagioclase in H6 chondrites (725-742°C) [2]. The concurrence of modal and normative plagioclase in Guarena suggests plagioclase crystallization was complete by type 6 conditions. In two other H6 chondrites, Canon City and Chiang Khan, the QUILF temperature estimates are 904±45°C and 877±64°C, respectively [8]. These temperatures are identical to that for Guarena, but plagioclase has not fully crystallized. Plagioclase temperature estimates are not available for Guarena, Canon City, or Chiang Khan, and it is not clear whether temperatures estimated using pyroxene and plagioclase within the same meteorite would yield a better correla-

References: