MAGNETIC PROPERTIES AND MÖSSBAUER ANALYSES OF GLASS FROM THE K-T BOUNDARY, BELOC, HAITI; F. E. Senftle and A. N. Thorpe, Howard University; L. May, A. Barkatt, M. A. Adel-Hadadi, and G. S. Marbury, The Catholic University of America; G. Izett, U. S. Geological Survey; H. Sigurdsson, University of Rhode Island; F. J.-M. R. Maurasse, Florida International University.

The experimental magnetic susceptibility, the temperature-independent component of the magnetic susceptibility, the magnetization, and the Curie constant have been measured for a number of specimens of glass from the K-T boundary found at Beloc, Haiti, and the results are compared with those of similar measurements of tektites. Because the Fe^{3+}/Fe^{2+} ratio is needed to calculate the magnetic parameters, Mössbauer spectroscopic measurements were also made. The data were consistent with the classification of the Beloc glasses as tektites.

Prior to magnetic measurements, the specimens were well cleaned in acid and ultrasonically scrubbed. Initially, five of the specimens were large enough to measure individually and the effects of surface contamination on the susceptibility were found to be negligible relative to those of the bulk volume of the sample. The experimental values of the Curie constant, magnetization, and the total magnetic susceptibility fall within the known range observed for tektites. However, the temperature-independent component of the magnetic susceptibility is generally a little higher than that found for tektites [1].

Beloc glass is often considered to be the same as tektite glass [2], but the previously reported Fe^{3+}/Fe^{2+} ratio of 0.7 [3] is substantially larger than that found for tektites. Accordingly, the values of the magnetic properties mentioned above were calculated using methods which have been found to be satisfactory for calculating the magnetic properties of tektite glass [1]. Calculations made on this basis using the reported Fe^{3+}/Fe^{2+} ratio of 0.7 do not compare favorably with the experimental data. However, if continuously smaller ratios are arbitrarily used in the calculations, the calculated values of the magnetic properties approach the experimental values. The reported Fe^{3+}/Fe^{2+} ratio was therefore suspected to be too high.

To check the above possibility, the Fe^{3+}/Fe^{2+} ratio of the five large normally cleaned specimens of Beloc glass was determined by Mössbauer spectroscopy. The Fe^{3+}/Fe^{2+} ratio was found to be 0.039 ± 0.018. The sample was then chemically analyzed and found to contain 3.75 percent total iron. Using these new data, the magnetic parameters were recalculated. The results compared quite well with the experimental values.

Subsequently, two collections of small glass beads were obtained from the same site in Haiti. One sample of small beads of glass was cleaned in the usual way using acid and ultrasonic scrubbing. Even after substantial cleaning, small amounts of smectite were found in microscopic pockets and indentations on the surface. To remove any oxidized iron in the outer layer of glass which may have been altered [3], the second sample was similarly cleaned except it was also heavily etched in HF to remove the surface layer to reveal the core glass. Both the normally cleaned and core glass samples were measured by Mössbauer spectroscopy. The first sample yielded a Fe^{3+}/Fe^{2+} ratio of 0.34 ± 0.02 while the core glass had a ratio of 0.025 ± 0.003, a value close to that of tektite glass.

Using the new ratio, the calculated and experimental values agree quite well. Apparently, the presence of small amounts of smectite, which contains ferric iron, or the presence of ferric iron in the outer layers of the glass beads, is sufficient to substantially increase the Fe^{3+}/Fe^{2+} ratio. When these sources of ferric iron were removed, a true value of the

Fe^{3+}/Fe^{2+} ratio of the core glass was obtained in the Mössbauer spectroscopy measurements. Magnetic measurements of the etched glass also showed the low Fe^{3+}/Fe^{2+} ratio to be valid.

The Haiti glasses are known to exhibit a considerable chemical variability [4,5]. Thus the variable Fe^{3+}/Fe^{2+} ratio of different glass spherules, and also possibly of cores and outer layers of the glass particles, may in part reflect this general chemical variability, and thus a real variation in oxidation state. This requires further study on a larger number of samples.

It was concluded that, based on its oxidation state and the magnetic properties, the Beloc glass can be considered to belong to the same type of glass as tektites. The only difference between Haitian glass and conventional tektites was the observation that the temperature-independent component of the magnetic susceptibility is a little higher than that found for tektites, while the other magnetic parameters, including the Fe^{3+}/Fe^{2+} ratio, are within the ranges found for tektites. The temperature-independent magnetic susceptibility has been ascribed to submicroscopic metallic iron in tektites [6,7]. If the slightly higher temperature-independent susceptibility is due to a slightly higher concentration of metallic iron in Beloc glass than in other tektites, then one can consider the Beloc glass as being essentially the same as normal tektite glass with a slightly higher concentration of metallic iron.

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