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The basic magnetic properties and shock metamorphism of Rumanova (H5) chondrite

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Rumanova showed evidence of recrystallized features by shock heating. We have investigated the basic magnetic properties of this chondirte. This NRM of Rumanova has high directional stability and may be indicative of shock related demagnetization. We suggest the NRM of Rumanova was acquired in the cloudy taenite and plessite in the presence of the internal local magnetic field of the parent body during shock impact.

Rumanova (H5) chondrite showed evidence of recrystallized features in the chondrules and matrix which we ascribe to shock heating, and impact deformation is further characterized by the presence of Neumann bands on kamacite grains (Rojkovic et. al., 1995). We have investigated the basic magnetic properties of Rumanova, with the purpose of evaluating criteria which might be related to the impact disturbance.

The natural remanent magnetization (NRM) stability of Rumanova was examined by AF demagnetization out to 50mT in steps of 5mT. The original NRM intensity 5.755x10-2Am2/kg decreased gradually and its direction shifted smooth out to 45mT. The magnetization at 50mT is insignificant because of the abrupt change in the direction between 45 to 50mT and the weak residual magnetization. When the sample acquired the saturation isothermal remanent magnetization (SIRM) due to a field of 0.8T, the intensity increased to 7.921x10-1Am2/kg. The REM value (NRM/SIRM) of 0.072 may suggest weak magnetic contamination by a hand magnet etc. (Wasilewski and Dickinson, 1998).

The 1st run thermomagnetic curve was measured in a magnetic field of 1.0T of the external magnetic field under 10-3 Pa atmospheric pressure. The curve yielded the clearly defined Curie point of taenite at 450 C and the phase transition from kamacite to taenite at 760 C and from taenite to kamacite at 630 C. No tetrataenite may be present in the sample due to absence of the apparent Curie point around 550 C. Fine-grained magnetic minerals are probably present due to relatively large coercive force (HC)=17.1mT, and remanent coercive force (HRC)=75.2, which were identified by the magnetic hysteresis loop. Another possibility for the large coercivity is shock hardening which remains to be evaluated.

A polished section was etched by NO2 and then it was observed by reflected light microscopy. The results indicated that the metallic grains consisted of kamacite,taeinte, plessite and cloudy taenite. Deformed Neumann bands decorate on the kamacite. When magnetic fluid was painted on the surface, the fluid accumulated on the cloudy taenite, but no accumulation was observed on the periphery of the cloudy taenite. The tetrataenite, when present, is formed along the periphery of taenite and cloudy taenite, and we therefore conclude that tetrataenite is absent by these microscopical observations.

The presence of Neumann bands suggest the shock level could not be higher than about 1GPa. However, from the partial melting of silicate phase (Rojkovic et al., 1995) the maximum local temperature suggests local shock levels much higher. If the shock level exceeds about 13GPa, the transformation microstructure is observed. We did not observe this microstructure. This NRM of Rumanova has high directional stability and may be indicative of shock related demagnetization. We suggest the NRM of Rumanova was acquired in the cloudy taenite and plessite in the presence of the internal local magnetic field of the parent body during shock impact.

References

Rojkovic, I., V. Porubcan and P. Siman (1995): Nalez meteoritu pri obci Rumanova. Mineralia Slovaca, 27, 331-342.

Wasilewski, P., and Dickinson, T. (1998): The role of magnetic contamination in meteorites. submitted to Meteorit . Planet. Sci.