

Ingella Station, a New Chondrite Find from the Tenham Strewnfield, Queensland, Australia

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Abstract—Based on optical microscopy and electron microprobe analysis of mafic minerals, Ingella Station, a new meteorite find from the area of the Tenham strewnfield, Queensland, Australia, is classified as an H5a chondrite.

THREE THIN SECTIONS (UNM 889, USNM 6391; UNM 941) were studied to classify Ingella Station into compositional group and petrologic type, using the criteria of Van Schmus and Wood (1967); the degree of shock modification was estimated following the criteria of Dodd and Jarosewich (1979). Electron microprobe analyses were made of olivine, pyroxene, and plagioclase using an ARL EMX-SM electron microprobe operated at 15 KeV and about 20 nA sample current. Differential matrix effects were corrected for using the method of Bence and Albee (1968); minerals of well-known compositions were used as standards.

Several specimens, the largest weighing 10 kg and approximately fifty smaller stones totalling 7 kg, were recovered from the area of the Tenham meteorite strewnfield, Queensland, Australia, 25°33' S, 142°47' E, in May, 1987, by Mr. Robert Haag. Mr. Haag informs us that in hand sample the stones are very similar. We have studied pieces from the 10 kg stone and one of the smaller stones. The 10 kg stone is in the Bally Museum, Schönenwerd, Switzerland. Three pieces representing the end of one of the smaller stones and weighing 214 grams, a 10-g piece from the Bally Museum specimen, and two polished thin sections (UNM 889; UNM 941) are in the collection of the Institute of Meteoritics, University of New Mexico. The United States National Museum has a 36 g sample and a polished thin section (USNM 6391). The remaining stones are in the Robert Haag Collection.

The Tenham strewnfield covers an area of 19 by 5 km. It has yielded approximately 200 Tenham stones with a total weight of 160 kg (Spencer, 1937). Hammond Downs, an H4 chondrite, was also recovered from this area (Mason, 1973), as was Ingella Station, thus giving testimony to the abundance of meteorites in arid areas.

The chondrule boundaries are relatively indistinct, although chondrules can be delineated. Barred olivine chondrules are particularly distinct. The common chondrule types are present. Chondrule mesostases are microgranular to acicular. Weathering is pervasive, with hydrous iron oxides occurring as veins, patches and pigments throughout. Fe-Ni metal is present but has been almost wholly altered to hydrated iron oxides. Troilite seems to be considerably more resistant to weathering than Fe-Ni metal, although hydrated iron oxides occur at grain boundaries and in cracks in troilite, as well.

Olivine has a mean Fa of 18.1 ($N = 20$, $\sigma = 0.24$, $PMD = 0.994$) and low-Ca pyroxene of Fs 15.9 ($N = 19$, $\sigma = 0.157$, $PMD = 0.927$) and Wo of 1.6%. Olivine has a mean CaO content of .02 wt.%. No high-Ca pyroxene was noted. Plagioclase is An 16.7 Ab 76.3 Or 6.6 ($N = 6$). Modal analysis of 1000 points indicates 0.1 wt. % metallic Fe-Ni and 1.7 wt. % troilite, unrealistically low due to terrestrial weathering. Polysynthetically twinned clinopyroxene is present, but rare.

The Ingella Station meteorite is classified as H5a. The means for olivine and low-Ca pyroxene are within the ranges for equilibrated H group chondrites (Keil and Fredriksson, 1964, as revised by Gomes and Keil, 1980). The type 5 classification is based on poorly delineated chondrule boundaries, recrystallization of chondrule mesostases, the occurrence of granoblastic feldspar ($> 15 \mu\text{m}$), the rare occurrence of polysynthetically twinned clinopyroxene, and on the mean Wo content of low-Ca pyroxenes of 1.6%, which is within the range of 1.2–1.6% for type 5 chondrites given by Scott *et al.* (1986). Shock facies "a" is indicated by the presence of fractured olivine with sharp extinction (Dodd and Jarosewich, 1979).

Tenham is an L6 chondrite, so Ingella Station is clearly not paired with it. However, the question arises whether it is paired with Hammond Downs, found around 1950 and classified as an H4 by Mason (1973). The most striking feature of Hammond Downs is its low degree of weathering, relative to Ingella Station. Modal analysis shows that it has 13.6 wt. % Fe-Ni and 5.4 wt. % troilite, much higher than Ingella Station, although low due to some terrestrial weathering. The time that elapsed between the recovery of the two meteorites would not have been sufficient for the differences in weathering. Hammond Downs displays a highly chondritic structure, quite unlike that of Ingella Station. Twinned clinopyroxene is abundant and plagioclase not readily apparent in Hammond Downs. Olivine of Hammond Downs is Fa 18.5 ($N = 9$, $\sigma = 0.848$, $PMD = 3.24$) and low-Ca pyroxene is Fs 16.3 ($N = 11$, $\sigma = 0.445$, $PMD = 2.12$), similar to Ingella Station. However, the mean Wo content of low-Ca pyroxene for Hammond Downs is 0.8%, considerably lower than that of Ingella Station and typical of a type 4 ordinary chondrite. It is therefore concluded that Ingella Station is a new chondrite find distinct from Hammond Downs and Tenham.

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REFERENCES

- BENCE A. E. AND ALBEE A. L. (1968) Empirical correction factors for the electron microanalysis of silicates and oxides. *J. Geol.* **76**, 382–403.
- DODD R. T. AND JAROSEWICH E. (1979) Incipient melting in and shock classification of L-group chondrites. *Earth Planet. Sci. Lett.* **44**, 335–340.
- GOMES C. B. AND KEIL K. (1980) *Brazilian Stone Meteorites*. U. of New Mexico Press, Albuquerque, NM, USA, 161 pp.
- KEIL K. AND FREDRIKSSON K. (1964) The iron, magnesium and calcium distribution in coexisting olivines and rhombic pyroxenes of chondrites. *J. Geophys. Res.* **69**, 3487–3515.
- MASON B. (1973) Hammond Downs, a new chondrite from the Tenham area, Queensland, Australia. *Meteoritics* **8**, 1–7.
- SCOTT E. R. D., TAYLOR G. J. AND KEIL K. (1986) Accretion, metamorphism, and brecciation of ordinary chondrites: Evidence from petrologic studies of meteorites from Roosevelt County, New Mexico. *Proc. Lunar Planet Sci.* **17th**, E115–E123.
- SPENCER L. J. (1937) The Tenham (Queensland) meteoritic shower of 1879. *Min. Mag.* **24**, 437–452.
- VAN SCHMUS W. R. AND WOOD J. A. (1967) A chemical-petrologic classification for the chondritic meteorites. *Geochim. Cosmochim. Acta* **31**, 747–765.