occur in chondrules crystallizing as closed systems, so sampling of a larger, chemically fractionated reservoir need not necessarily be invoked, although silica-rich clasts provide evidence that an analogous process occurred in larger, open igneous systems [3].

Some silica undersaturated mineral assemblages in mesostases may also be explained by closed-system crystallization within chondrules. A radiating pyroxene chondrule in Chainpur (Chr1) contains interstitial nepheline and scapolite. Metastable crystallization of enstatite from an initially chondritic melt composition, at low pressure, can create silica undersaturated residua. The LREE-enriched abundances of the Chr1 mesostasis minerals are consistent with this, having up to 19× OC La and Eu/Eu* = 10 [4]. Similarly, nepheline-bearing mesostasis identified in two Parnallee (LL3.6) chondrules (P6, P22) may have crystallized from residual chondrule liquid. Other feldspathoid occurrences in chondrule mesostases cannot be explained in this way. Chondrule CC1 (type IIAB, Chainpur) consists of sodalite (≤7 wt% Cl), nepheline, An_{88-91}, and pyroxene (En_{75}, Fs_{16}, Wo_9) dendrites in a texture suggesting devitrification. This alkaline assemblage cannot simply be a residuum following crystallization of the phenocrysts because they are predominantly olivine. Mobilization of alkali fluids within UOC parent bodies, after the formation of chondrules, is probably responsible for "white matrix" [4], but low-temperature metasomatism cannot be invoked for CC1 because its texture indicates that the mesostasis assemblage is derived from a melt. Instead, there could have been a late influx of alkali elements into the precursor melt. A similar conclusion was reached for the FELINE nepheline-rich clast [5] and the feldspathoid-bearing SA-1 basaltic clast [6]. If true, the CC1 precursor melt may, like that of FELINE, have originated within an open igneous system on a planetary body. Oxygen isotopic data is being collected on these and other samples in order to help ascertain whether the alkali-enriched melts envisaged are from normal OC reservoirs or exotic sources [5].

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THE FALL OF THE ST. ROBERT METEORITE: INTERPRETATION OF EYEWITNESS ACCOUNTS, SATELLITE DATA, SHORT-LIVED ISOTOPE ACTIVITY, AND INFRASOUND.

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The St. Robert meteoroid (a monomict H5 breccia) entered the Earth's atmosphere at 00:02 UT on June 15, 1994, approximately 1 hr before local sunset. The resulting daylight fireball was widely observed from the provinces of Ontario and Quebec and the states of New York, Vermont, and New Hampshire. The fireball was first observed over New York state at an altitude of ~60 km traveling in a north-northeast direction to its point of terminal burst ~60 km northeast of Montreal. At least one observer noted electrophonic sounds heard simultaneously with the passage of the fireball. Several episodes of fragmentation occurred at the end point near an altitude of ~33 km, with observers reporting several clumps of dust along the trajectory. Eyewitnesses to the explosion described multidirectional debris dispersal. A prominent dust trail persisted for ~10 min after the passage of the fireball. The terminal burst produced loud detonations audible for more than 200 km and of sufficient strength to shake buildings throughout metropolitan Montreal.

Twenty fragments of this meteorite have been recovered in a fall ellipse of 7.5 × 4 km located near the farming community of St. Robert. Total recovered mass to date is ~25.4 kg, but the shower of meteorites was sufficiently dense, in at least the uprange part of the ellipse, so that one fragment partially penetrated the roof of a farmer's shed, and two fragments were found on roads. The most productive UTM grid square of 1-km sides yielded six meteorites. From the searched fraction of this square kilometer, and a search efficiency of ~0.5 due to ground conditions and subsequent ground disturbance by farming, we estimate that ~25 meteorites fell in this grid square. This concentration implies that as many as 100 fragments >55 g (the smallest recovered) may have fallen. Eighteen of the recovered fragments were completely covered by dark fusion crusts with surfaces showing varying degrees of ablation in accord with the multiple fragmentation episodes observed. Most fragments were found in shallow pits up to ~50 cm deep in the soft clay and sand soils of the region. Dedicated searches by interested local residents and members of the Meteorites and Impacts Advisory Committee to the Canadian Space Agency (and friends) recovered half of the known fragments.

Interpretation of the eyewitness data suggests that the fireball traveled from south-southwest to north-northeast with a moderate slope from the horizontal of 15°–35°. An evaluation of the probable orbits for the meteoroid suggests an entry velocity in the range 12–15 km/s. The object moved in a low-inclination orbit with perihelion very near the Earth's orbit. The total mass estimated to have reached the ground is 50–100 kg, while the preatmospheric mass derived from visual observations is found to be on the order of 1000 kg.

The fireball of the St. Robert meteorite shower was also observed from above by sensors located on Department of Defense satellites. In the visual, the fireball reached a peak magnitude of −18 during its terminal flare and the observations suggest a lengthy period of fragmentation lasting perhaps as long as 1 s near the end point. Data reduction is proceeding on infrared observations of the fireball, and initial mass estimates will be derived for the preatmospheric meteoroid from infrasound considerations, short-lived isotope measurements for 8 of the 20 fragments, and dynamical information from eyewitness data in addition to satellite measurements.

The St. Robert meteorite shower affords the first opportunity to combine satellite and eyewitness observations of the hypervelocity entry of a natural object into the Earth's atmosphere together with "ground truth" from the surviving remnants of the object's atmospheric passage.

FEATURES RESEMBLING PSEUDOTACHYLYTE AT THE ENCHANTED ROCK BATHOLITH, TEXAS.

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Enchanted Rock batholith in central Texas is a granitic pluton with an area of ~250 km² [1]. The batholith intrudes Precambrian metamorphic rocks and is dated by Rb-Sr at 1048 ± 34 m.y. [2]. Plutonic rocks are exposed in a series of exfoliation domes located along the southeastern edge of the batholith. Numerous subvertical fractures occur along the outer margins of the intrusion and, in a few cases, between exfoliation domes. A number of these fractures contain veins described as pseudotachylytes by Barnes [3]. In hand specimen, the veins resemble pseudotachylytes, forming a branching network and containing angular fragments of local country rock in a fine-grained matrix that locally exhibits an apparent flow texture. Some smaller veins appear to have been injected into host rock.

The veins range in width up to ~30 cm with boundaries that are sharp and smooth with undulating surfaces. Thin (~4–5-cm) aplite dikes cut the granite and generally show small amounts of displacement where intersected by the fracture veins (maximum measured apparent displacement ~75 cm). Matrix material in veins includes fragments of quartz, feldspar, biotite, and opaques. Matrix biotite is generally associated with opaques and occurs as numerous tiny, oriented flakes between fragments of feldspar and quartz in areas that are darker than surrounding matrix. The flowlike textures of matrix materials are defined by these darker areas, which are elongated subparallel to fracture direction. The finer-grained matrix biotite apparently