New Evidence for the 1,850 My Sudbury Meteorite Impact

JORMA KALLIOKOSKI

In 2005 a paper was published in *Geology* by W.D. Addison, G.R. Brumpton and others describing a peculiar breccia that the senior authors had discovered in drill cores both in northwestern Ontario and 260 km to the south, in northeastern Minnesota. The breccia occurs as a stratigraphic layer above the famous Proterozoic iron formations (the banded iron-oxide/chert beds which, on subsequent oxidation or metamorphism, converted to iron ores) and the overlying darker shales. On the basis of textural field studies and petrographic work, the paper concludes that the layer was produced by a meteorite impact. Because new age dates from above and below this breccia layer bracket the date of 1,850 My assigned to the Sudbury impact, the paper concludes that the breccia was produced by that same meteorite which hit the Earth some 875 km to the east. The authors also propose that because of the obvious magnitude of the impact, evidence for this event should be found in strata of the same age elsewhere in the world. The findings constitute a major scientific discovery, absolutely mind-boggling in its implications, and represents a complete unanticipated, independent confirmation of the Sudbury impact event.

Their prediction has been verified by subsequent discoveries in Michigan. Whereas in Ontario and Minnesota the iron-formation-bearing beds are only slightly inclined, in Michigan the strata occur within thick, variously metamorphosed, highly folded and faulted stratigraphic packages (iron ranges, each with a geographic name). As recorded in recent Proceedings of the Institute on Lake Superior Geology, similar complex breccia layers have been identified by geologists of the United States Geological Survey and others in several of these iron ranges, again at the top of the iron formation and below the dark shale. Components in the breccias have been firmly dated to be of Sudbury age. The Michigan occurrences extend from 500 to 900 km west of Sudbury and are separated from the original discoveries in Ontario and Minnesota by the west half of Lake Superior. So far over a dozen papers have been presented or published on the subject, and the various breccia textures have been interpreted as fallout, ground-surge, seismite, and/or tsunami-modified.

The breccia localities have been the focus of many organized field trips and have generated much discussion. In addition to the pre-

diction of wide-spread distribution, the original paper also pointed out that comparative studies can now be made on these breccias and those derived from the Chixculub event in the Yucatan. They also noted that because the breccias generally overlie iron formation (more oxidized) and in turn are overlain by dark shale (more reduced), perhaps the impact and the associated debris in some way affected the prevailing ocean geochemistry.

In Michigan the discovery in some of the iron ranges of the time-line represented by the breccia, will now facilitate the study of basin-wide Proterozoic sedimentation. The age dates from the breccias have lead also to a parallel revelation. An age date derived from a Proterozoic volcanic massive sulfide deposit (VMS) in the southernmost part of northern Michigan, about 50 km southeast of the nearest iron range, shows its age to be near that of the breccia. That is, about the time that these sulfides were accumulating in one basin in a volcanic regime, iron oxides were being deposited in another basin.

Now comes another amazing part of the story. It should be recalled that over the years these iron formations have been evaluated for ore potential with thousands of diamond drill holes prior to mining, and that cores were studied by all of the famous names associated with Lake Superior Precambrian geology. Bill Addison and Greg Brumpton, the two who made the initial discovery, are not geologists at all, but are high school science teachers without degrees in geology. Having open minds, they were able to recognize a peculiar rock textures as something out of the ordinary. They also had the curiosity and perseverance to continue the study, and to convince professional friends to join them. Their efforts have opened the door to a completely new aspect of Proterozoic geology. The only other somewhat similar situation that comes to mind of amateurs making a major scientific discovery, comes from meteoritics. In that instance, D. Levy, an amateur astronomer, shared honors with Eugene Shoemaker for discovering the Shoemaker-Levy 9 Meteorite Swarm in 1985 and which subsequently collided with Jupiter, resulting in headline news and follow-up studies.

JORMA KALLIOKOSKI
Corresponding Member
Houghton, Michigan

Merkki-päiviä

85 v.	Olavi Granö	27.5.
80 v.	Yrjö Vasari	7.5.
70 v.	Pirjo-Liisa Karhumaa	7.5.
	Gunnar Glückert	22.5.
	Lauri Eskola	27.5.
	Kari Kaartamo	30.5.
60 v.	Ilkka Tuokko	21.4.