

Montagnais Meteorite Impact

Lubomir Jansa and Georgia Pe-Piper ABSTRACT

The first of only three known offshore impact structures, Montagnais has a short core from fractured Meguma Group (Cambro-Ordovician) recovered in Union et al. Montagnais I-94. In 1987 a report in *Nature* (v.327, p. 612-614) was followed up by a 1989 larger article by Jansa, L.F., Pe-Piper, G. Robertson, P.B., and Friedenreich, O. in *Geological Society of America*, v. 101, p.450-463. Although the effects of meteorite impacts on land has been relatively well studied (including as significant hydrocarbon-bearing structures) those on the 70% of the water-covered earth are much less understood. An underwater extraterrestrial impact crater occurs on the North Atlantic continental shelf, 200 km southeast of Nova Scotia, Canada. The impact, in late early Eocene (51 Ma) produced a complex structure with a submarine crater, a central structural high and an inner topographic ring. The crater is filled with breccia, which exhibits shock deformation features. Lack of enrichment of the melt rocks in siderophile elements compared with basement rocks and a slight enrichment in iridium suggest that the impactor was either a stony meteorite or a cometary nucleus. The diameter of the impactor is estimated to be about 2-3 km.

The cored section is about 400 m below the top of basement in the central uplift of the crater. Megascopically it resembles Meguma Group metagreywackes and phyllites exposed on land in southern Nova Scotia. The metagreywackes from the core have hairline microfractures and rare undecorated shock lamellae in quartz grains, visible in thin sections. Other evidence for the impact structure was based on petrographic examination of cuttings and included the recognition of thick breccias, melt zones of rhyolitic composition containing calcic plagioclase, and shock-induced features of minerals including isotropization and shock-induced lamellae.

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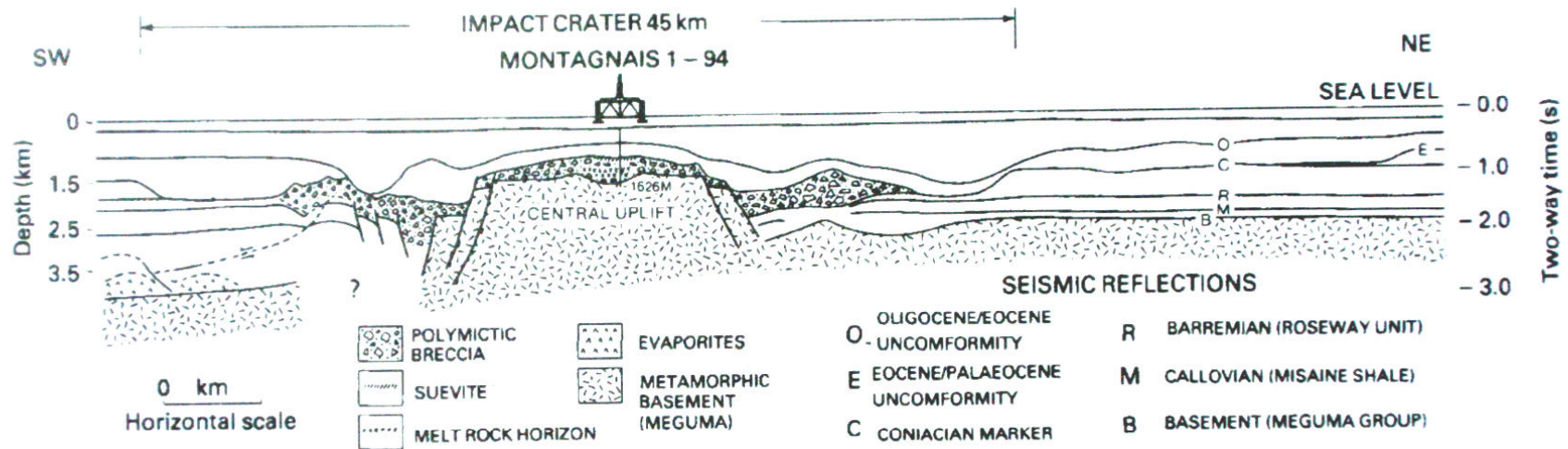
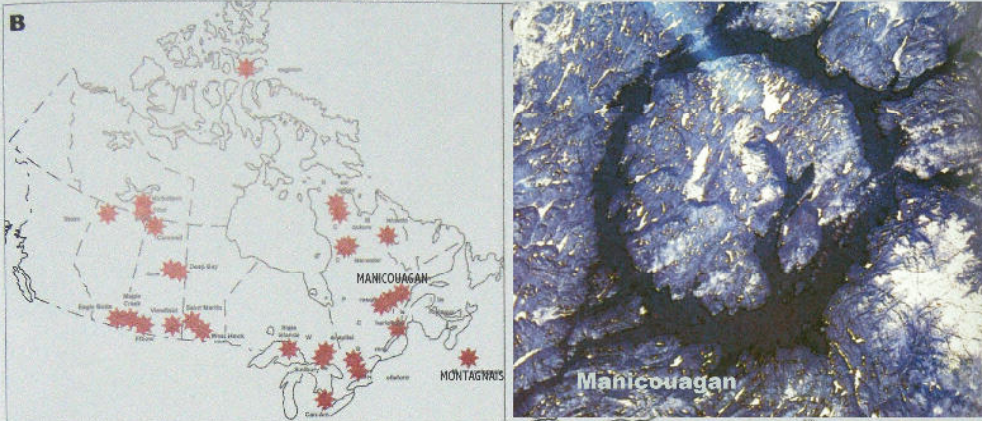


Fig. 1 Interpreted multi-channel reflection seismic section of the Montagnais impact structure. The seismic line connects two oil exploratory wells on the Scotian Shelf, the Mohawk B-93 and Montagnais I-94. The seismic line 3203-82 has been provided by Petro-Canada and partners.

ASTROBLEMES IN CANADA (modified from Eyles and Miall 2007)



Crater	Age (Ma)	Diameter (km)	Crater	Age (Ma)	Diameter (km)	Crater	Age (Ma)	Diameter (km)
New Quebec	1.4	3.5	Manicouagan	214	100	La Moirerie	400	8
Haughton	2.3	24	Saint Martin	220	40	Couture	430	8
Wanapitei	37	8	Gow	250	5	Pilot	445	6
Mistastin	37	30	Clearwater (W,E)	290	30	Slate Islands	450	30
Montagnais	51	45	Ile Rouleau	300	4	Presqu'île	500	24
Eagle Butte	<65	10	Charlevoix	342	54	Holleford	550	2
Maple Creek	75	6	West Hawk	350	4	Can-Am	800-600	100
Steen River	91	25	Elbow	395	8	Sudbury	1.85 Ga	250
Deep Bay	100	13	Brent	395	4			
Carswell	115	39	Nicholson	400	12.5			
Viewfield	190	2.5						

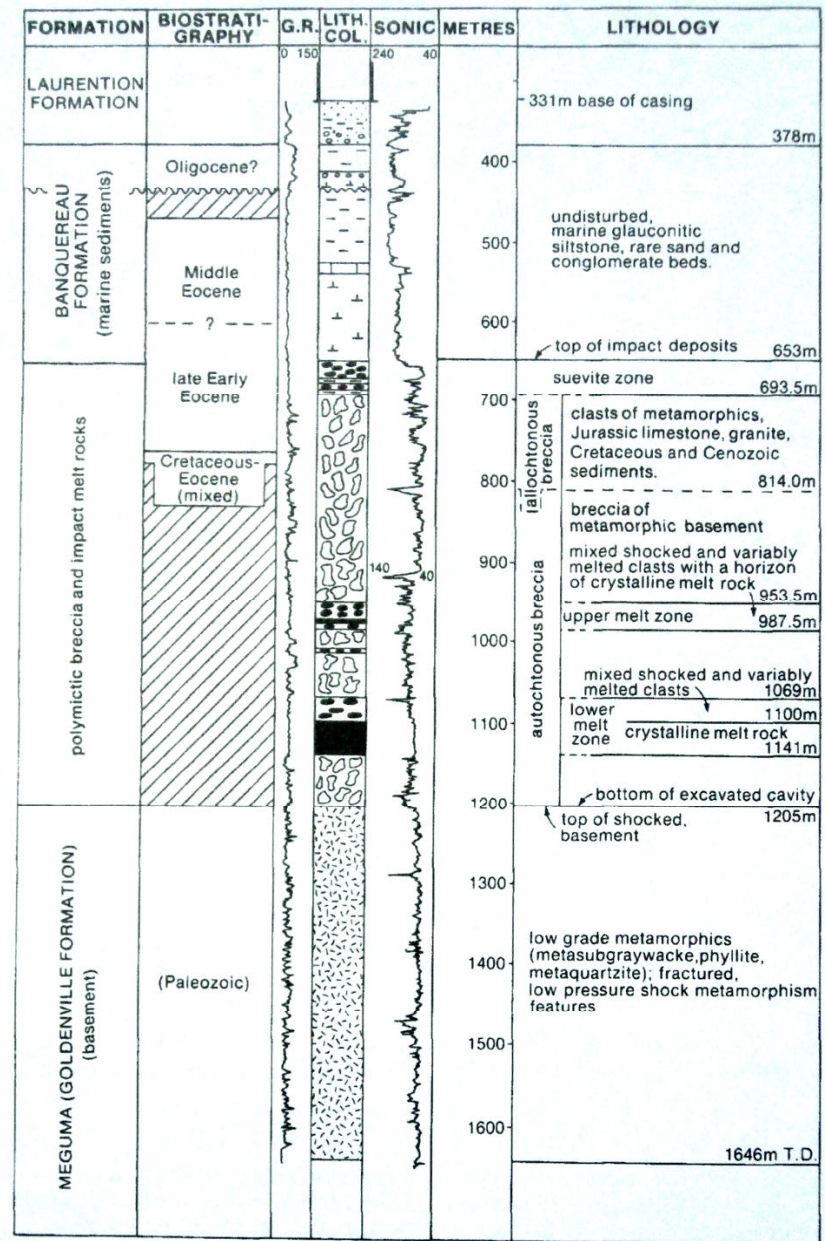
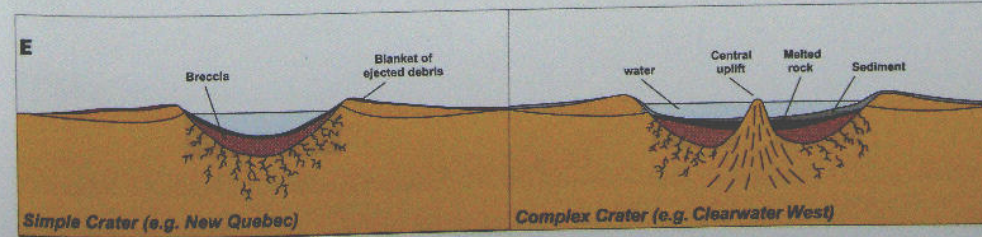
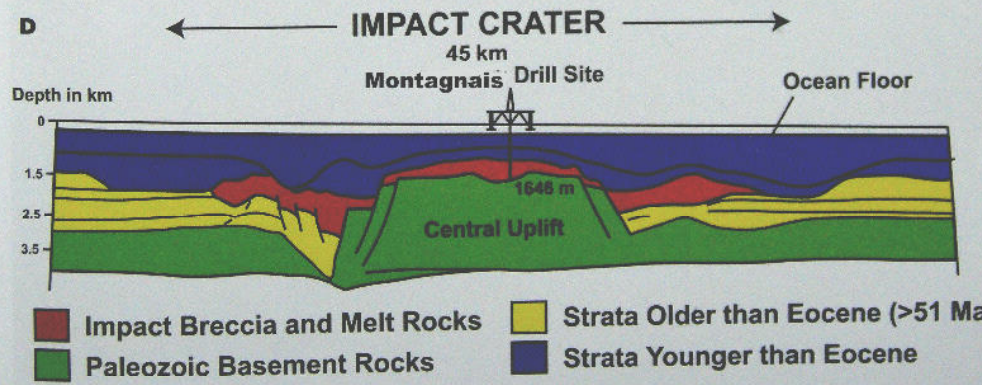


Figure 4. Vertical stratigraphic column of the Union *et al.* Montagnais I-94 exploratory well. The well encountered three main lithologic units: (1) slightly shocked Paleozoic basement, (2) zone of shocked breccia and impact melt rocks, and (3) undisturbed cover of Cenozoic sediments. G.R. = gamma-ray log, Lith. col. = generalized lithological column. Note: scale change on sonic log at 908.6 m. Depths are measured from rotary table, 30 m above sea level. The water depth is 112.7 m.