The Late Devonian Canowindra lagerstätte: new data, new ideas

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The Canowindra lagerstätte of the Mandagery Formation (Late Devonian Hervey Group) contains a wealth of superbly preserved placoderm (armoured plated) fish fossils in the Lachlan Orogen, southeastern Australia. Key features of the fish bed are [1]: the fine detail of preservation, suggestive of gentle burial; fish generally crowded in life position, side-by side and confined to one layer; and the lack of disturbance, which suggests rapid death. Previous ideas on death invoke drying up of a lagoon or billabong [1]. In contrast, we suggest the local depositional environment was probably shallow marine, part of a brief marine incursion from the east. The fish are encased in grey shale (Z-X Li. pers.comm., 2018), bounded above and below by quartz-rich sandstone with a late Famennian maximum depositional U-Pb age of 363±3.1 Ma, younger than previously thought. This new age not only better constrains the age of the Mandagery Formation, with the fish bed lying only ~30 m above the base and not in the upper part as previously thought, but also allows better correlation with other Late Devonian extinction events.

Our new age date for the fish bed correlates with the second major igneous pulse of 364.4 ± 1.7 Ma in the Viluy Traps, a Large Igneous Province in eastern Siberia and also with timing of Kola, Vyatka, and Pripyat-Dniepr-Donets rift systems in Eastern Europe [2]. However, anlyses of the grey layer did not yield any volcanic detritus: it is very fine-grained (<2μm), consisting of quartz (>85%), and mica (<15%), the same major minerals as in the enclosing sandstones. Another possibile cause of extinction is a contribution from the 120km diameter Woodleigh crater in the western Australia, with an estimated age of 364 ± 8 Ma [3]. Anoxia is another possibility. End-Frasnian anoxic events in Europe [4] appear too old, and there appears little evidence of them in the Gogo Formation of Western Australia [5]. However, we suggest that the Canowindra lagerstätte may reflect the end-Famennian Hangenberg anoxic extinction event, dated at 359 Ma [6].

[1] Johanson (1998) *Records of the Australian Museum*, **50**, 315–348. [2] Percival *et al*. (2018) *Scientific Reports* **8**, 9578 [3] Barash (2016) *Oceanology* **56**, 863-875. [4] Bond *et al*. (2004) *Geological Magazine* **141**, 173-193. [5] George *et al*. (2014) *Geology*, **42**, 327–330. [6] Myrow *et al*. (2014) *Terra Nova*, **26**, 222-229.