

TECTONIC DEFORMATION INDICATED BY FOSSILS: AN EXAMPLE OF THE PERMIAN BIVALVES OF THE FALKLAND ISLANDS

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ABSTRACT: Non-marine bivalve specimens recently described as *Palaeoanodonta* cf. *P. dubia* from the Middle Permian Brenton Loch Formation, Falkland Islands, exhibit morphological variations that are tied to tectonic deformation. The Brenton Loch Formation is up to 70 m thick and is characterized by the interbedding of very fine sandstones, claystones and laminated siltstones, deposited in quiet waters alternating with episodic sedimentation of prodeltaic hyperpynal flows (see Warren *et al.*, this volume). The shells of *Palaeoanodonta* cf. *P. dubia* were collected from the top of the succession exposed in the Walker's Creek Farm, East Falkland, in laminated interbeds of claystone and siltstone, dark-grey in colour, decimetre to centimetre in thickness. The specimens were found dispersed and lying concordantly to bedding, and preserved as silicified shells, as well as internal and external molds, without any sign of abrasion and/or bioerosion. The shells are commonly splayed open in a convex-up attitude and, more rarely, as closed articulated pairs. Both valves in each specimen show different shapes, being the right valve commonly more elongated than the left valve, a morphological condition especially evident in the splayed open specimens. One of the valves of a given single specimen tends to lie parallel to the bedding, while the other valve does not. This is because, at the time of deposition, the commissural planes of articulated open valves tended to form an acute angle instead of a straight angle. Hence, valves of the same specimen are not equally deformed. The specimens are deformed in oblique or anterior-posterior plane of the valves, or even laterally. Specimens with anterior-posterior compression are deformed in such a manner that they have exaggerated width (obesity). Because of deformation, the spectrum of morphological variation shown by the Brenton Loch bivalves is an artifact of preservation. In such way those bivalves are *taphotaxons*. Hence, they are invalid as biological entities. In our case study, this "intraspecimen" morphological variation reflects post-depositional deformation. The main cause seems to be related to the tectonic history of the Falkland microplate. East Falkland was subject to Permo-Triassic southern verging folding, with axes striking E–W to WNW–ESE, which implies a general N–S-trending compression. Deformation of the bivalves should be correlated with such compression, with the resulting shapes arising from their individual positions in relation to the orientation of tectonic stress. In this way, the bivalve shells of the Brenton Loch Formation provide a good example of how morphology can be modified by taphonomical factors – as tectonics – other than biology. Finally, should be noted that the alpha taxonomy of many Carboniferous to Permian bivalve species is extremely over-split. This is because most morphological variations are linked to the mode of life of these bivalves (ecomorphophenotypic). As shown here, taphonomy is another factor

that could contribute for those morphological variations and must be considered in the systematic studies of the Late Paleozoic freshwater bivalves.