RECENT HYPOTHESES ON MECHANICAL AND METABOLIC FUNCTIONS OF SEPTAL FLUTING AND SUTURAL COMPLEXITY IN POST-CARBONIFEROUS AMMONOIDS

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Two recent papers suppose that septal fluting and sutural 'complexity' functioned primarily metabolically, not mechanically (see Hewitt & Westermann (1997; Lethaia 30:191-204). Higher-order fluting, resulting in increased complexity, was limited to the septum margin and accompanied by thinning, so that the suture acted like a spring or shock absorber. The centre of strong septa was progressively thickened to compensate for stress concentrations. The central/marginal thickness ratio and sutural complexity tended to increase with habitat depth within higher taxa of Mesozoic ammonoids.

Oloriz, Palqvist & Peres-Claros (1997; Lethaia 30: 205-212) found no significant differences in fractal-dimension values between epicontinental-platform and epioceanic-swell habitats. They conclude that sutural complexity was unrelated to depth. However: (1) They do not consider whorl diameter, which is positively correlated with fractal-dimension values, nor the scale of the illustrations used. (2) Most of their ammonoid families occur in both megafacies, but strong sutural simplification has been observed in, e.g., epeiric (<100 m) phylloceratids and lytoceratids versus their oceanic (>200 m) relatives (depths based on shell strength). (3) Orders/Suborders were lumped together disregarding strong phylogenetic effects. (4) Shell-strength data should be used for bathymetry. I predict if the authors consider my objections that they will find general trends of increasing sutural complexity and amplitude (approximation) with habitat depth within Suborders.

Daniel, Helmuth, Saunders & Ward (1997; Paleobiology: 23: 470-481) use a mathematical model to 'disprove' all strength functions of septal fluting in circular whorl-sections; hence fluting functioned only/mainly metabolically. Indeed, fluted septa are weaker against surface pressure than ancestral semi-hemispherical septa, but not against peripheral load where flutes formed struts supporting the flanks of compressed whorls of the first ammonoids. They stress higher-order fluting to have progressively weakened the septum; hence habitat depth varied inversely with sutural complexity. However, in real septa (1) higher-order fluting did not extend to septum centre; (2) the centre thickened with increasing complexity and margins thinned; (3) basic septal curvature was spherical (not parabolic). (4) Their 'complexity factor', i.e. number of lobes, is strongly correlated with whorl compression and should not be combined with 'sinuosity'. Their conclusion that suture complexity increased mechanical risk and limited depth is therefore valid. Their substitute, metabolic model, i.e. complexity improves cameral liquid transport during re-flooding, if valid provides only a secondary function.