

## Relationships between dimensionless models of ammonoid shell morphology

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In morphological studies the shape may be conveniently quantified by relative dimensions or dimensionless quantities. The analyses of shell morphology and morphospace occupation have been historically approached mainly by means of statistical analysis on classical dimensions (distance measurements: diameter, umbilical width, whorl width, whorl height and apertural whorl height), the Raup's coiling and expansion rate parameters and, more recently, by means of the ADA-model which conjugates the classical variables in a single simple equation. Relationships between these studies should be possible based on mathematical equivalences between classical dimensions and those of coiling and expansion rates. These equivalences, which are presented in this paper, have been obtained on the basis of the ADA-model and a new general method for deriving dimensionless models of morphology based on exponential trajectories as a function of a rotational angle.

**Key words:** Ammonoid shell, morphology, size, shape, morphospace.

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