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Spacing vs bed thickness of pressure solution cleavage in carbonate rocks: insights from the Sibillini thrust sheet (Italy).

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Pressure solution cleavage is one of the most important deformation structures developing in carbonate successions occurring both in fold-and-thrust belts and in unfolded foreland sectors. Stylolitic cleavages generally consist of highly irregular stratabound dissolution surfaces with residues of insoluble materials regarded as the hallmarks of the pressure solution process. Relationships between the pressure solution process and both the acting stress field and the environmental conditions of deformation have been widely studied, particularly at the microscale. On the other hand, it is still under debate whether, at the outcrop scale, the pressure solution phenomenon (i.e. the development of pressure solution cleavage arrays) is an organized process or not and if cleavage spacing relates or not to the thickness of the host layers.

This work reports on relationships between spacing and bed thickness of tectonic pressure solution cleavages from the Umbria-Marche carbonate multilayer in the Sibillini thrust sheet of the Northern Apennines (Italy). The dataset consist of 1768 stratabound pressure solution cleavages near perpendicular to bedding and striking about parallel to the fold axial trend. Data were collected in different mechanical units and in different fold positions (i.e. in the backlimb, crest and in the forelimb). Statistical analysis of this dataset strongly suggests that the spacing of pressure solution cleavages relates to the host-layer thickness. In particular, the relationship between cleavage spacing and bed thickness can be successfully approximated by a linear trough-the-origin fit, supporting the use of bed thickness vs cleavage spacing ratio (H/S) to quantify the

cleavage “intensity”. Statistical data analysis also supports the concomitance of both layer-parallel shortening and episodic infilling to determine the final H/S distribution of pressure solution cleavage.