Cave Inception and Development in Caledonide Metacarbonate Rocks

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This is the first comprehensive study of cave inception and development in metacarbonate rocks. The main study area is a 40000km2 region in central Scandinavia that contains over 1000 individual metacarbonate outcrops, and has nearly 1000 recorded karst caves (with passage lengths up to 5.6km). The area, which was repeatedly glaciated in the late Cenozoic, comprises a suite of nappes in the Cambro–Silurian Caledonides, a paleic range of mountains with terranes presently occurring on both sides of the northern Atlantic. Information about the stripe karst and non-stripe karst outcrops and their contained caves was assembled into computer-based databases, enabling relationships between the internal attributes of the caves and their external geological and geomorphological environments to be analysed. A rather consistent pattern emerged. For example, karst hydrological system distances are invariably shorter than 3.5km, and cave passages are positioned randomly in a vertical dimension, whilst commonly remaining within 50m of the overlying surface. This consistency is suggestive that the relevant cave inception, development and removal processes operated at a regional scale, and over long timescales. A consequence of the epigean association of caves with the landscape is that cave development can only be understood in the context of the geomorphological evolution of the host region. A review of the latest knowledge of the inception and development of caves in sedimentary limestones concluded that the speleogenesis of the central Scandinavian caves cannot be explained by these ideas. Five new inter-related conceptual models are constructed to explain cave development in metacarbonate rocks in the various Caledonide terranes.