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Down by the water- Aerenchyma in Devonian and early Carboniferous plants.

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Aerenchyma is a specialized plant tissue containing enlarged gas spaces formed either by differential growth and cell separation (schizogeny) or by cell death (lysigeny). Today, aerenchyma is formed constitutively in the roots, shoots, and leaves of aquatic plants, and in response to poor soil aeration in wetland plants. Its presence can thus be used as a proxy for plant adaptation to flooded and aquatic habitats in the fossil record. This talk will review selected occurrences of aerenchyma in Devonian and early Carboniferous plants based on the literature and on new data to (1) provide a new understanding of the evolution of this tissue, and (2) discuss the anatomical evidence for the oldest aquatic vascular plants.

Aerenchyma is present in early Devonian plants, including in the cortex of taxa from the Rhynie chert such as *Asteroxylon*. It has been reported in several cladoxylopid s.l. stems, and is particularly well-developed in the central ground tissue of *Pietzschia levis*. Aerenchyma is also present in an unnamed iridopteridale from the Late Devonian of Australia, where it is located in the inner part of the cortex. One of the best examples of aerenchyma in late Devonian-early Carboniferous plants however is the enigmatic genera *Periastron*, known from the New Albany Shales in Kentucky, Erin Slate in Alabama (USA), the Russchiefer of Saalfeld (Germany) and the Lydienne Formation (France). Additional specimens from the Lydienne Formation bring new information on the structure of the aerenchyma and on the way it was formed. The extensive presence of aerenchyma in an organ interpreted as a petiole suggests that the parent plant was aquatic. While the plant fossil record is known to have a strong bias towards the preservation of wetland taxa, this is the oldest anatomical evidence of a complex vascular plant adapted to fully aquatic life.