



Hydrocarbon seeps from close to the Jurassic–Cretaceous boundary, Svalbard

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ABSTRACT

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Fifteen carbonate bodies, interpreted as having been formed at hydrocarbon seeps, have been found in the Sassenfjorden area of Spitsbergen, Svalbard. The bodies, up to 5 m wide, are found in the siltstones and mudstones of the uppermost Slottsmøya Member, in the Upper Jurassic to lowermost Cretaceous Agardhfjellet Formation. The age of the seeps is close to the Volgian–Ryazanian (Jurassic–Cretaceous) boundary, and the Mjølner impact event in the Barents Sea. The Sassenfjorden area carbonates show complex and heterogeneous structures typical of hydrocarbon seeps, including zoned (botryoidal) cement textures, fissure-infilling sparite, and breccias. Stable isotope analyses show highly negative $\delta^{13}\text{C}$ values (down to ca. -43% VPDB) in the zoned carbonate cements, consistent with authigenic precipitation in a hydrocarbon-rich environment. Oxygen isotopes indicate secondary hydrothermal activity. The species-rich, well-preserved fauna includes at least 13 species of small to medium sized bivalves, some of which are abundant, as well as rarer rhynchonelliform and lingulid brachiopods, gastropods, echinoderms, sponges, and serpulid and probable vestimentiferan worm tubes. Although several bivalves (solemyids, lucinids, and probably *Thyasira* and *Nucinella*) had chemosymbionts, the Sassenfjorden seep fauna contains few, if any, seep obligate taxa, consistent with formation in a relatively shallow-water paleoenvironment. The seeps contain the earliest record of thyasirid bivalves, and a species-rich (six) brachiopod fauna including the first lingulid recorded in a seep environment. Ammonites, belemnites and large wood fragments represent *ex situ* fossils in the seep carbonate bodies.

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