

# The Norwegian tafone: A common, yet overlooked and poorly described landform

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**Tafoni** (Tafoni plural, Tafone singular), a term first used scientifically by renowned Norwegian geologist Hans Reusch after his excursion to Corsica in 1876, refers to cavities ranging from centimeters to meters in size that form in rock (Reusch, 1882). Despite Norway's long-standing tradition of studying these landforms, they have been largely overlooked, leaving gaps in our understanding of their distribution and formation processes within the Norwegian and Scandinavian contexts.

Internationally, Tafoni are quite well-documented, particularly in coastal, arid, and polar environments. Recent studies have revealed that coastal Tafoni in Norway can cause significant local weathering, leading to erosion rates of several decimeters per thousand years (Andersen et al., 2022). Furthermore, ongoing mapping efforts have shown that Tafoni are present both along the coast and in inland Norway (Øverland, 2020). They exhibit a wide range of sizes and morphologies and occur in various lithologies, making their formation processes elusive. Tafoni in their essence are not able to hold standing waterbodies. They need to be distinguished from other small-scale bowl-like depressions, of which there are plentiful.

Various formation processes for Tafoni have been proposed in international literature, with mechanical weathering, especially salt weathering (haloclasty), being a common factor. Haloclasty occurs when saline solutions infiltrate rock fissures and mineral grain boundaries, depositing salt crystals. As the rock dries and heats under solar radiation, these salt crystals expand differentially, exerting pressure on the surrounding mineral grains and causing the rock to disintegrate mechanically.

In a newly discovered, spectacular Tafoni site in Stjørdal, central Norway, detailed studies tell us that haloclasty plays a significant role in Tafoni formation here. Thin sections, XRD and XRF data indicate that phyllosilicates like biotite and clay minerals such as chlorite residing interstitially between the primary rock-forming minerals may also undergo physical expansion through weathering. This process aids both the disintegration of the rock and the infiltration of saline solutions. We propose that haloclasty in our opinion are the most likely contributor to physical expansion. Other mechanical and chemical weathering processes might also contribute to further development, but to a lesser extent. Our findings are likely transferable to other tafoni localities in Norway.

The formation of Tafoni is complex, requiring careful petrographic studies combined with analysis of rock geochemistry and environmental settings to fully understand their formation processes. Our findings and observations suggest that Tafoni are common geological features in Norway. They can cause rapid disintegration and erosion of bedrock, at geographically smaller areas. Their overall impact on the Norwegian landscape remains to be quantified.

## References (format style Heading)

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