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The early life of a salt giant: 3D seismic study on syn-tectonic Zechstein salt and stringer deposition on the Friesland Platform, Netherlands

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The Zechstein of the NE-Netherlands is generally thought to have been deposited in a tectonically quiet environment, although Mark Geluk proposed the Tubantian I and Tubantian II tectonic phases during the Zechstein deposition. In this study we attempted to test this hypothesis using very high-quality 3D seismic and well data from the Friesland Platform, where salt tectonics after deposition was minor. We mapped in detail the seismic reflections of the 30 m thick anhydrite - carbonate Z3 stringer, which is encased in thick layers of rock salt and acts as a strain marker. Results show that the stringer contains (i) a regional network of thicker zones, and (ii) zones where the stringers are absent (ANVIS), interpreted as ruptures formed by salt flow. These ruptures in many cases mark a clear vertical shift of the sub-horizontal stringer. Mapping of the base salt and top salt reflectors shows that the ruptures often correlate with faults at base Zechstein level, and that the thickness of the post-stringer Z3 and Z4 salt layers is thicker above the offset stringers, while the total Zechstein salt thickness is relatively constant. We interpret these structures as evidence for movement on the basement faults during the Zechstein, providing strong evidence that Zechstein deposition was syn-tectonic. Based on this we propose that movement on basement faults and associated early rupture of the stringers was common during Zechstein deposition. In most areas these subtle structures are difficult to prove because they are overprinted by later salt tectonics, however these early ruptures can have major effects on the evolution of the internal structure of later pillows and diapirs.