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Tectonic, Eustatic and Sedimentary Controls on Depositional Sequences during the Middle to Upper Jurassic in the Viking Graben Area, North Sea

The Middle to Upper Jurassic in the North Sea Viking Graben was deposited during an overall transgression linked to the breakup of Pangea. Tectonics, eustasy, sediment supply, and sediment source area control facies distribution and basin fill. The Lower Toarcian to the base of the Cretaceous consists of seven major depositional cycles that occur on a 5 to 11 million year scale (2nd order). Each 2nd order cycle is associated with a change in depocenter that is correlated with a period of higher tectonic activity. Sedimentation rates and the thickness of the depositional cycles are greatest where where tectonic activity is concentrated. The first 3 cycles occur during a minor rift phase when sedimentation was more likely to keep up with subsidence. The last 4 cycles were deposited during a major rift phase where sedimentation was localized and was less likely to keep up with subsidence.

The paleobathymetric profile created by regional and local tectonics dictates facies types. The relatively simple tectonics of the early rift phase led to uniform sediment and facies distribution. Numerous sub-basins formed during the major rifting phase created heterogeneous facies distributions.

The 7 2nd order cycles are subdivided into 14 minor facies cycles deposited on an approximately 1-2 million year scale (third order).

Third order cycles are sensitive to sediment supply and are not clearly expressed if sedimentation rates are insufficient. Source area dictates sediment types. Uplift and erosion of Paleozoic and Triassic sandstones yield sand-rich sediments, while erosion of Caledonian schists yields shale-rich sediments.