

Lithofacies Attributes and Depositional System of the Late Carboniferous-Early Permian Haushi Group, Oman Interior Basin, Sultanate of Oman

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Abstract

Siliciclastic sediments of the Haushi Group host major hydrocarbon reserves in Oman Interior Basin. It is comprised of glaciogenic Al Khlata and fluvial Gharif formations deposited during Late Carboniferous-Early Permian age. The Haushi Group was deposited in Oman Interior Basin coeval with rift tectonics along the eastern and northern margins of the Arabian Plate following the Hercynian Orogeny. The uplifted rift margins were probable source of sediments in newly formed continental basin. The Al Khlata Formation is 0-800 m thick comprising sandy and silty diamictite, sandstone and shale. The sediments were deposited in glacial, glacio-fluvial and glacio-lacustrine setting. The thickness variation of the formation is due to subsurface Eocambrian salt withdrawal in response to subsequent sediment deposition especially during glacier loading. Large scale halokinensis resulted in a number of pod-shaped basins filled with glaciogenic sediments. A 60 m thick shale unit known as Rahab Shale is distributed across the basin constituting the uppermost part of the formation. The Rahab Shale was deposited in extensive lakes formed due to late stage glacier melting. Most of the reservoir sand occurs in the lower sandy part of the formation generally known as P9 while Rahab Shale constitutes an excellent top seal.

The Gharif Formation on average is 200 m thick; however at places in central and southern parts of the basin it is up to 330 m thick representing depocenter of the Gharif basin. The formation is divided into Lower, Middle and Upper Gharif members on the basis of relative abundance of the sandstone and siltstone. The upper member comprising thick sandstone constitutes an important reservoir in the Oman Interior Basin. The sandstone lithofacies, on average, constitute tens of meters thick multistoreyed sequences which are composed internally of two to three meters thick and hundreds of meters across vertically amalgamated and laterally coalesced sandstone bodies. It was deposited by braided and meandering river systems which pass up-section into coastal setting with wide spread swampy conditions represented by thick organic clays interbedded with sandstone.

In this study we interpret the depositional setting of the Haushi Group in the subsurface and correlate it with the outcrop analogues in the Huqf area. We also demonstrate the effects of salt removal on thickness variations of these formations in various parts of the Oman Interior Basin, especially its southeastern part.