

# **Predicting Potential Carbonate Reservoirs Exploration Targets Based on Key Factors Controlling Hydrocarbon Accumulation - A Case Study from the Lower Ordovician Yingshan Formation in Tazhong Area, NW China**

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## **Abstract**

Geological conditions for Ordovician hydrocarbon accumulation in Tazhong area, Tarim Basin, are characterized by multiple stages of hydrocarbon generation, accumulation, adjustment and alteration. Despite decades of exploration and production, mechanisms of hydrocarbon accumulation and their controlling factors are still not well established, which were the key restrictions on progress in oil and gas prospecting today. Using geological, geochemical and geophysical technology to analyze the geological setting and the distribution characteristics of the reservoirs, we reveal the mechanisms of hydrocarbon accumulation, provide quantitative evidence of the key controlling factors, and attempt to predict potential exploration targets of Lower Ordovician Yingshan Formation in Tazhong area. Our results show that hydrocarbons in the Yingshan Formation reservoirs came from mixed sources including middle-lower Cambrian and middle-Lower Ordovician source rocks within the Tazhong area and Majiaer Sag. Four accumulation periods are recognized. Hydrocarbons migrated into the Tazhong area along eleven intersections of NE and NW fault sets, principally from the northwest to the southeast. The Lower Ordovician Yingshan Formation carbonate reservoirs are typically lithologically defined and the dynamic of hydrocarbon accumulation is primarily differential capillary forces. The accumulation and distribution of hydrocarbons in the Yingshan Formation were controlled by excellent reservoirs and hydrocarbon charge energy. The physical properties of excellent reservoirs control the petroliferous features and the hydrocarbon accumulation threshold: these reservoirs have a threshold with the minimum porosity and permeability, approximately 1.8% and 0.1 mD, and have a threshold with the maximum capillary forces, approximately 2.5 MPa. Hydrocarbon charge energy controls the hydrocarbon enrichment range: hydrocarbons enriched in areas near hydrocarbon injection points and the hydrocarbon charge distance threshold of 20 km. Excellent reservoirs and hydrocarbon charge energy coupled index (RSI) controls hydrocarbon accumulation and distribution. Accumulation does not occur when the value of RSI is <0.5, but is favoured when values are higher. The coupled index is used to predict reservoirs in the Yingshan Formation are mainly distributed in the northeastern area of the ZG17-TZ72 well field.