

DEVELOPMENT AND DISTRIBUTION OF LATE PERMIAN WARM WATER CARBONATES ON SUBTROPICAL DYNAMIC TETHYAN INDIAN SHELF

Mukhtiar Ghani^{1,2} Irfan U. Jan¹, and Hafiz Shahid Hussain^{1,3}

¹National Center of Excellence in Geology, University of Peshawar.,

² Geological Survey of Pakistan, Saria road Quetta.,

³ Pakistan Museum of Natural History, Islamabad.

Abstract

The warm water Late Permian Zaluch Group, i.e. Amb, Wargal and Chhidru Formations were researched for their development and basinal distribution on microfacies level through petrographic and petrophysical data in the Upper Indus Basin. For petrographic analysis, the data of three Outcrops i.e. Zaluch, Nammal, and Gulakhel gorges and ditch cuttings from Bahu-01 Well were used. The petrophysical analysis is carried out with well data from Isakhel-01, Dhermund-01, Khaur Oxy-01 and Bahu-01 wells. The basin-wide distribution of the formations showed, that during Late Permian, the carbonate shelf was continuously shifting from south-east to north-west. In Late Permian, the Wordian Amb formation marked the most extended carbonate on the Peninsular Indian and Tethyan shelf. It is extended from Rajasthan basin in SE India and culminated in Kohat basin in NW with maximum thickness within upper Punjab platform. The Capitanian Wargal Formation is restricted to the Upper Indus Basin with depocenter in eastern Salt Range. The Changhsingian Chhidru Formation further moved to northwest with limited presence in NW of Upper Indus Basin having depocenter in Trans-Indus basin. Overall, the shelf moved to northwest from south east during Late Permian time. The Amb Formation yielded four microfacies, i.e. bioclastic packstone (AM-1), siliciclastic bioclastic wackestone (AM-2), bioclastic wackestone (AM-3), and siliciclastic wackestone microfacies (AM-4). The facies modelling showed that facies AM-1 is thickly deposited in the south and northeastern part of the basin, while facies AM-2 is mainly present in north of the basin. Facies AM-3 and AM-4 are uniformly distributed throughout the basin. The overlying Wargal Formation contained five microfacies, i.e. bioclastic peloidal grainstone (WR-1), algal stromatolitic mudstone (WR-2), quartz wackestone (WR-3), dolomitic mudstone (WR-4) and bioclastic packstone microfacies (WR-5). Facies WR-1 and WR-5 decreased in thickness towards SE and increased towards NW. The facies WR-2 showed good thickness in the north while facies WR-3 is restricted to the west of the basin. Facies WR-4 is found to be uniformly present in the basin. The Chhidru Formation had four facies, including siliciclastic mud-wackestone (CF-1), siliciclastic packstone (CF-2), siliciclastic wackestone (CF-3) and sandstone facies (CF-4). The facies CF-1 and CF-3 are widely and evenly distributed in the basin. Facies CF-2 is comparatively more thick in north, while facies CF-4 is thick in the south. Overall, the changes in thickness and composition of microfacies showed a continuously changing dynamic paleoenvironment and fluctuating sea level in the Late Permian time.