

Sedimentary facies analysis and depositional model of the Palaeogene West Crocker submarine fan system, NW Borneo

Abstract

This study outlines a sedimentological analysis of the Palaeogene West Crocker Formation (WCF) around the Kota Kinabalu area of SW Sabah, which represents a large submarine fan depositional system within part of what was the complex and tectonically active margin of NW Borneo. The newly acquired and often extensive outcrop data summarised in this study has resulted in a more complete synthesis of the Crocker fan depositional system than has been previously possible. Seven facies (F1 to F7) have been identified which constitute three main facies groups: (1) sand-dominated facies (F1 to F3), comprise high- to low-density turbidites and form the dominant part of the WCF, (2) debris flow-dominated facies (F4 to F6) comprises mud- and sand-dominant debris flows and mass transport deposits (MTD), which form a secondary but highly distinctive part of the WCF, and (3) mudstone-dominated facies (F7), represent a subordinate part of the WCF. Analysis of the vertical facies successions (from proximal to distal), has resulted in recognition of five major genetic units: (1) Channel-levee complex; characterised by thick (30-60 m) thinning and fining upward facies succession, which are dominated in their lower part by thick-bedded (1-6 m), amalgamated high-density (Lowe-type) turbidites with rare debrite beds; the upper part is dominated by low-density (Bouma-type) turbidites, without associated debrite beds. (2) Channelised lobes; characterized by 2-10 m thick, coarsening upward, which are overlain by 5-20 m thick fining upward facies successions; these successions are dominated by high-density turbidites (c. 0.5-1 m thick) and linked co-genetic turbidite-debrite beds (0.1-0.5 m thick), with subordinate mudstone facies. (3) Non-channelised lobes; comprise 5-20 m thick coarsening upward facies successions; these start with mudstone facies, which pass gradually upwards into linked co-genetic turbidite-debrite beds; sandstone bed thickness increases upwards, while the debrite caps tend to become thinner upwards; high-density turbidites (2-3 m thick beds) form amalgamated units at the top of these successions. (4) Distal lobes; represented mudstone-dom

inated intervals with mainly thin (1-10 cm thick) low-density turbidites and occasional muddy debrites. (5) Mass transport complexes (MTCs); characterized by highly deformed slumped units (up to 2.5-5 m thick). It is inferred that the five genetic units were deposited within four proposed laterally contiguous depositional environments are: (1) inner fan channel-levee complex; (2) mid-fan channelised lobes; (3) mid-fan non-channelised lobes; and (4) outer fan distal lobes. The West Crocker submarine fan is interpreted as a multiple-sourced, shelf-fed, Type II, low- efficiency, sand-rich depositional system.