AAPG HEDBERG CONFERENCE
"Variations in Fluvial-Deltaic and Coastal Reservoirs Deposited in Tropical Environments"
April 29 - May 2, 2009 — Jakarta, Indonesia

The late Holocene progradation event of the mixed fluvial-tidal Mahakam Delta, imaged using very high resolution shallow seismics.

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Introduction

The late-Holocene Mahakam delta, located along the tropical eastern shore of Kalimantan, Indonesia, prograded seaward about 60 km during the past 5000 years, under conditions of rising sea level. Simultaneously, the subaqueous rollover point prograded 100 kilometres. The Mahakam river supplied very large amounts of sediment during the progradation event, as the average water depth was 60 m (Roberts & Sydow, 2003) resulting in a significant delta volume. The Mahakam delta is a unique delta because of the strict separation of fluvial and tidal domains. Additionally the similarity to the hydrocarbon-producing Miocene delta make it a unique opportunity to study a recent reservoir analogue in a practically unchanged location and sedimentary setting (Allen et al, 1976l Allen and Chambers, 1998). The sedimentary architecture of fluvial channel sands and mouthbar amalgamations encased in marine and tidally deposited claystones make for a complex reservoir setting. By characterizing the recent analogues we hope to better understand the distribution of highly permeable zones in the ancient deposits.

Echosounder profiling

Most previous work on seismic and core data, focused beyond the sub-tidal zone, therefore the extension of the distribution of deltaic facies in relation to tidal- and fluvial dynamics remains unexplored.

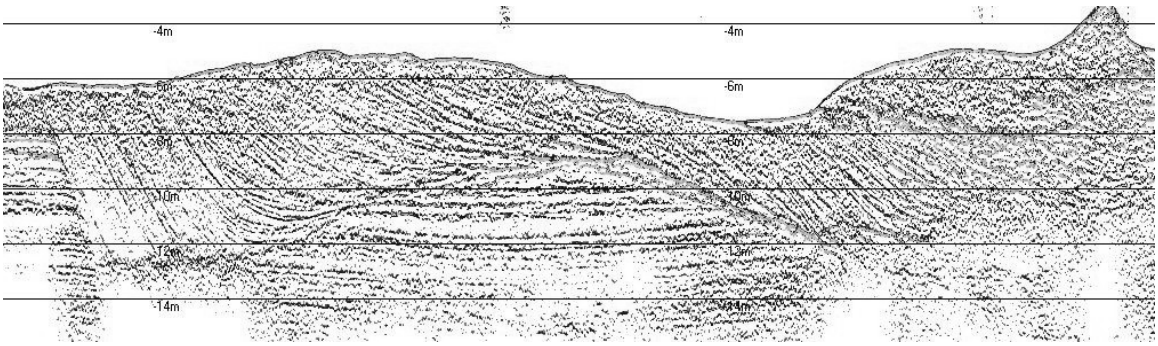

Figure 1; Cross section profile of a channel fill in a meander bend. Note the change in elevation of the paleo-channel floor. The channel is filled by lateral accretion, changes in angle are most likely caused by change in direction of accretion.

We made a detailed very high resolution seismic/bathymetric survey of the delta platform in the tidal zone up into the fluvial and tidal channels using the Innomar Parametric Echosounder (**www.innomar.com**) in the delta channels and over the submerged delta platform. This innovative instrument is capable of producing images of the subsurface with a resolution on dm scale, moreover data can be obtained at very shallow water depths (1 m).Unprecedented detail in the subsurface characterization was obtained. Figure 1 shows a profile of a composite channel-fill shot in a tidal channel. Careful interpretation of the data is necessary as much of the profiles were shot in highly sinuous tidal channels, thus cross-cutting many subsurface features. Figure 2 illustrates a prograding clinoforms which gradually change to a more aggradational stacking pattern, due to localized sealevel rise or an increase in sediment supply.

Coring

Based on a pilot survey 10 shallow corings (up to 22 m bsf) where carried out, which allows us to study a continuous section of submerged deltaic sediments in high detail. These cores allow us to tie sedimentary facies to the high resolution seismic profiles.

Future work/discussion

Dating and grainsize analysis will be performed to reconstruct the sealevel curve for East Kalimantan and to link the Holocene sea-level to changes in the depositional pattern. In combination with 3D interpretation of the very high resolution seismics we can obtain a static model of sedimentary architecture of the late Holocene delta and relate this to autogenic or allogenic forcing mechanisms. The strong biogeomorphological influence on depositional pattern and sedimentary architecture will be further explored. The apparent robust segregation of fluvial and tidal channels will be analysed, to determine whether the segregation fluctuates through time or is truly constant.

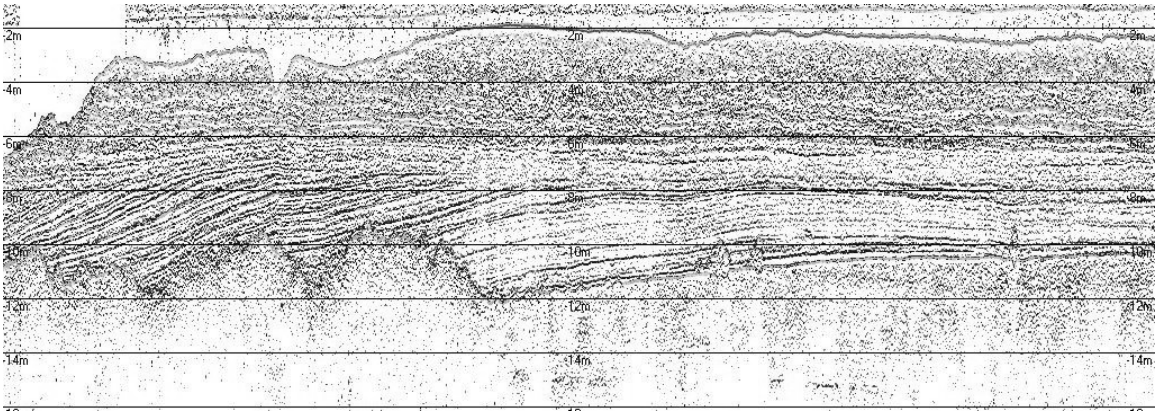

Figure 2; Prograding clinoforms overlain by aggrading parallel beds. Note the irregular surface is produced by postsedimentation infiltration of shallow gas.