Quantitative Architectural Analysis and Depositional Model of an Asymmetric Conglomerate-Rich Submarine Channel Fill, Cerro Toro Formation, Sierra del Toro, Magallanes Basin, Chile

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Asymmetry is defined as both the cross-sectional profile of the channelform and the facies distribution within that form. Although a ubiquitous feature of sinuous fluvial channels, asymmetry of submarine channels is poorly documented and rarely incorporated in numerical, experimental, and reservoir models. With superb three-dimensional exposure, the conglomeratic axial channel-belt of the Upper Cretaceous Cerro Toro Formation, southern Chile, provides an excellent opportunity to study submarine channel asymmetry and its impacts on reservoir heterogeneity. Exposures of the channel belt at Sierra del Toro record a 3.5 km wide, 300 m thick channel complex here named the Wildcat complex.

The Wildcat complex has a low sinuosity (1.03) meandering planform and thus exhibits slight cross-sectional asymmetry. However, the fill of the channel complex is highly asymmetric. Twelve measured sections, bed tracing, and photopanel correlation demonstrate that grain size, bed thickness, amount of amalgamation, and margin architecture all vary drastically from outer to inner bend. The outer bend is characterized by thick-bedded, conglomeratic, amalgamated facies as well as a sandy overbank accumulation. The inner bend is notably different, where thin-bedded, sandy and muddy facies onlap a composite margin adjacent to a predominantly muddy overbank.

These observations have been incorporated into a predictive depositional model of asymmetric submarine channel evolution. This model predicts the cross-sectional profile, facies distribution, margin architecture, and planform shape of asymmetric channels as well as their respective overbank environments. The modern Monterey fan-channel, a great modern analog to this system in terms of grain size, channel width, channel depth, and facies asymmetry, is used to refine the channel asymmetry model. Results of this study are broadly applicable for outcrop, modern, subsurface, and flume experimental datasets and the corresponding quantitative data can be used to constrain numerical and reservoir models built for sinuous submarine channels.