

## **RMS-SEPM talk September 2010**

### **Four Dimensional Sedimentation Patterns in the Denver Basin, Colorado**

Marieke Dechesne

*Denver Museum of Nature and Science*

The Denver Basin, where most of us live and work, has been studied extensively for its natural resources, including water, oil, gas and uranium and is pierced by well over 150,000 bore holes. This study focuses on the Upper Cretaceous through Eocene strata that form the main aquifers of the basin in the subsurface, and also contain important fossil localities on the surface. However, surface outcrops are scattered and scarce and the integration of surface with subsurface data is key to understanding the stratigraphy of the basin. Both the Denver Museum of Nature & Science and the Colorado Geological Survey have been studying these Laramide synorogenic units for over the last ten years and we decided to join our forces and databases about two years ago. This led to the creation of two products that will be published in the near future. The first publication contains 15 cross sections through the Denver Basin focusing on the Fox Hills Sandstone through the Eocene strata in the basin, and outlines the aquifer delineations and interpreted stratigraphy for these units. The second publication is a 1:250,000 scale bedrock geologic map of the basin, created by extrapolating subsurface structure maps to the scattered surface outcrops. This publication includes 3 cross sections, 5 structure maps, 4 isopach maps and 3 paleogeographic maps. Our well log database currently contains over 3500 well logs and combined with the available time control in the basin, allows for detailed spatial analysis of sediment accumulation patterns.

As accommodation varies from west to east within the basin at a given time, sediment accumulation rates differ dramatically within each unit, influencing facies distribution patterns. A pattern of at least twice the sediment accumulation in the west versus the east of the basin can be recognized in most units and starts within the Pierre Shale, a unit deposited before the Front Range uplifted. For the beach and upper shoreface deposits of the overall basin-ward stepping shingles of the Fox Hills Sandstone, this means local vertical stacking in high accommodation areas on the west side of the basin and lateral migration and few step ups in low accommodation areas on the east side of the basin. The synorogenic units, divided into two sequences, show an initial coarse grained pulse of sediment into the basin by the Arapahoe Conglomerate, marking the uplift of the Front Range. This period is followed by a period of megafans, now forming the main aquifers of the basin. Over time these fans generally decreased in size and occurrence, but sediment accumulation remained at a steady pace and barely decreased. Preliminary comparisons to the nearby Cheyenne basin suggest that availability of accommodation space and not the type of sediment input or proximity to the mountains is the most important factor leading to preservation of thick packages of strata in this setting.

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