An icehouse to greenhouse transition in Permian through Triassic sediments, Central Transantarctic Mountains, Antarctica Peter Flaig, Bureau of Economic Geology

Icehouse vs. Greenhouse



Icehouse vs. Greenhouse



Icehouse vs. Greenhouse





Gornitz, 2009

Heading to Svalbard... so why talk about Antarctica?

Svalbard and Antarctica both spent some time at high latitudes (in both modern and ancient times)

Both currently have little to no vegetation (laterally extensive outcrop exposures)

Some rocks are from similar time periods (compare Svalbard, northern hemisphere to Antarctica, southern hemisphere)

Can use Antarctic strata to show you some qualities of outcrop belts and sediments that we use to understand ancient environments

Understanding how changing environments are expressed in outcrops (Svalbard trip) helps us predict reservoir quality and reservoir geometries



From overall geometries- to facies- to environments

Idea:

Step back and look at the outcrop as a whole (large scale)

Look at the inetrplay between sand and mud deposition and preservation

Make some prediction about reservoirs vs. source rocks and bad vs. good reservoirs

Look closer at the facies to help us refine our interpretations (smaller scale)

Central Transantarctic Mountains Geology



SVALBARD







Catuneanu, 2004



Transantarctic Basin = retroarc foreland basin



Long et al., 2008

Collinson et al., 2006





Land Strength and Strength Land Strength Land Strength Land Strength

300 m

Jurassic sill (Gondwana breakup)

A Sense of Scale



Laterally-extensive exposures- lacking vegetation

Icehouse Antarctica, ~290 MA



Isbell et al., 2008 Isbell et al., 2012





Pagoda Formation



Koch and Isbell, 2012





Koch and Isbell, 2012

Jurassic sill (Gondwana breakup)

Mackellar Fm

Pagoda Fm

Outcrop Architecture Pagoda Formation



F



Mackellar Formation

Vast inland sea with salinities reduced by steady influx of freshwater, likely from melting glaciers

Veevers & Powell, 1994













Mackellar Formation

F

W

Miller & Frisch, 1987

Fairchild Formation

Deltas prograde into the sea, beginning to fill the basin from east to west

Veevers & Powell, 1994

Mackellar-Fairchild transition = delta, delta front, prodelta, and submarine channels

FIG. 17.—Photo of the <u>Ferron delta-front</u> sandstones overlying thick, prodeltaic mudstones of the Tununk Shale Member, Last Chance Delta Complex. View from Bear Gulch looking east across the Miller Canyon Road (located in Fig. 5B).

Bhattacharya and MacEachern, 2009

Bhattacharya and MacEachern, 2009

(if we had well data, none in Antarctica)

Miller and Isbell, 2010

Buckley Formation

Permian-Triassic Boundary

Fremouw Formation

Fremouw Formation

Fremouw Formation

Sandstone Composition

Summary

Icehouse to greenhouse transition in Antarctic strata

Can use facies and architectures in outcrop belts, along with other rock properties, to understand ancient environments and assess reservoir potential (reservoir quality, reservoir geometries, source rock)

