The Athabasca Oil Sands

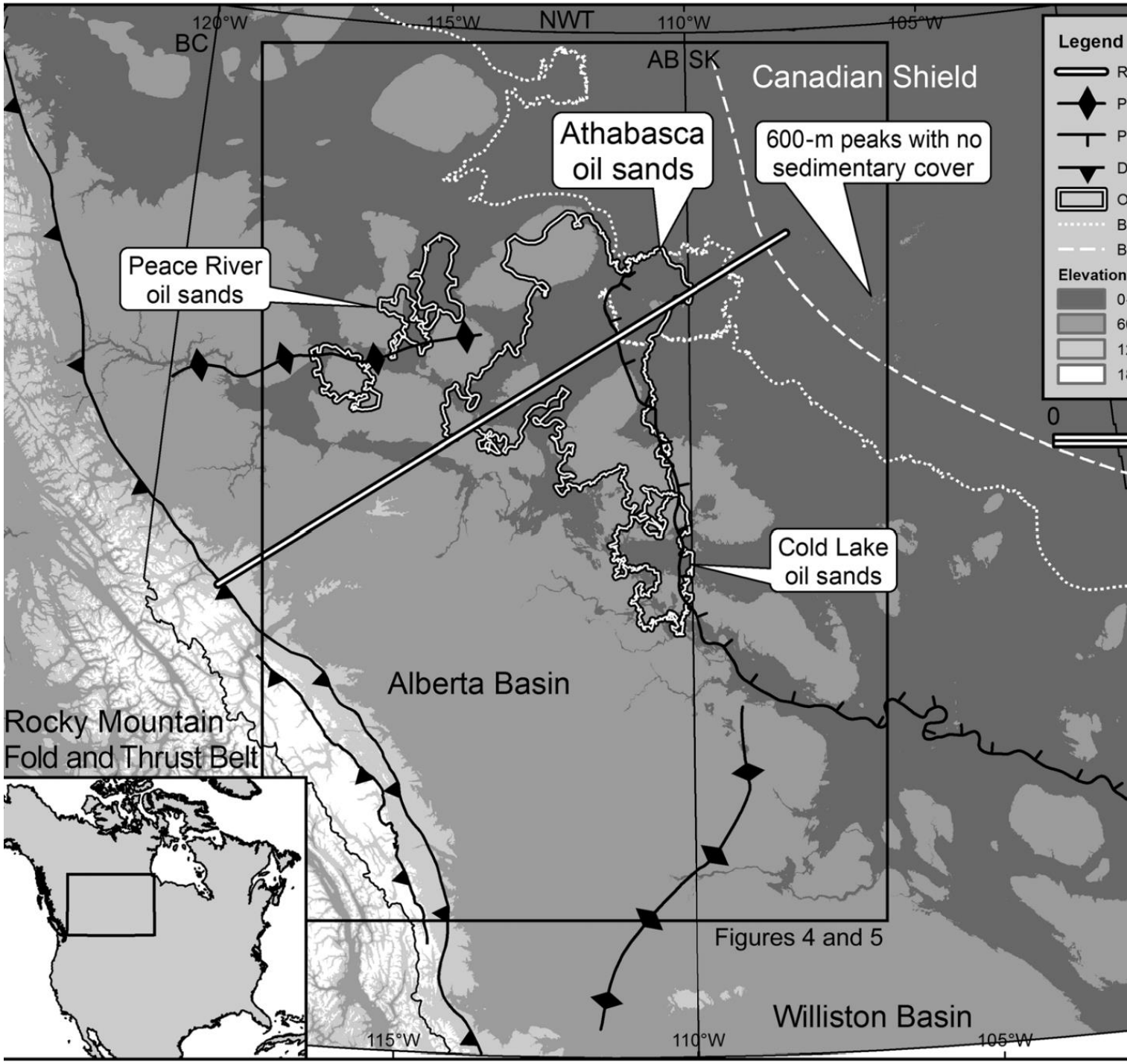
Presentation by Jake Flury For ES 486 (Petroleum Geology)

Introduction and Baseline Information

- The Athabasca Oil Sands are found in and around the northeastern side of Alberta, Canada
- It is estimated to contain somewhere around 1 trillion bbl of oil, held in Lower Cretaceous Wabiskaw and McMurray reservoirs of these sands.
- The Trap is somewhat shallow in the subsurface so their location is known. However, the trap mechanism is generally unknown due to the fact that the original trap was destroyed.
- They are trying to reconstruct the originaltrap.

Map of The Sands

- Shown on the side is a top down view showing the outline of where the sands are roughly located.



THE ISSUE

- So what is the issue of these sands?
- The issue is as follows, The original trapping mechanism that helped form and create the Athabasca oil sands was destroyed due to uplift, flexing, and erosion. This creates a missing link in its formation, original structure and geometry.
- The problem is being tackled by a group of geoscientists who are striving to try to reconstruct a model of what the original formation may have looked like.

Methodology

- In terms of methodology, and trying to come to a conclusion, it is especially important to understand three things. The rock ages, previous studies on the area, and the overall geologic setting of the area.
- Starting with the rock ages. It is generally understood that the rocks included in this oil bearing area is somewhere around the cretaceous period. This helps to understand the time period it was formed in, which could allow clues into the original source trap of this reservoir.
- Using recent geological studies of the area, they are able to collect data points for things like elevation, rock composition, and location. These points correspond to the whole reservoir.

Methodology pt 2

- Continuing what I was saying previous, the geological units of data can help understand how these were formed. They have to also take into account erosion over geologic time.
- Looking into it more, there are many cretaceous unconformities in the area.
- Removing the eroded wells and other picks helps to understand the formation.
- In terms of methodology for solving this, this is really all there is. A baseline understanding of the geologic information of the area can lead them to understanding the formation.

Results

- So, the results of this. Using geologic information, the scientists were in fact able to reconstruct the different contacts and traps of the area in question.
- To sum up the enormous amount of information in a short presentable way, I will explain the findings on the next slide. A photo of the results will be displayed.

Findings

- So here you can see the results. They found that centrally, it was a four-way anticlinal trap, and the NE part was an onlap trap. The rest were a bitumen trap.
- The bitumen trap is a form of trap where scientists assume it was once an oil-water contact. When overburden occurs to restore the trap, it should also return the BWC to its original location. This was assumed for the other four areas of the massive reservoir.

Trap Domain	Trap Type	Area (km^2)	% of Total Area
Central Athabasca	Structural trap (four-way anticline)	23,444	43.6
Northeastern Athabasca	Stratigraphic (onlap) trap	3617	6.7
Northern Athabasca	Bitumen trap	12,910	24.0
Southern Athabasca	Bitumen trap	1393	2.6
Southwestern Athabasca	Bitumen trap	4762	8.8
Wabasca	Bitumen trap	7684	14.3
Total		53,810	

Conclusion

- In conclusion, it is generally understood that the most important and prevalent trap in the reconstruction of the original is a four way anticlinal trap with dimensions 285x125 Km. Max amplitude of 60 m.
- They have found also with structural restoration that they are able to split the sands into five additional traps, NE of this anticline is a stratigraphic Onlap trap, and the other four around it are described as bitumen traps.
- This trap restoration has been tested by many scientists, and is presently recognized as the correct restoration of this trap.

Final conclusion.

- Finally to conclude, the depths of the trap domains are included.
- What you need to know from this piece of information is that these differences in elevation correlate to that of a four way anticlinal trap.

The trap restoration has been tested by restoring the McMurray BWC using the overlying 84-Ma Colorado horizon (late Santonian). The restored BWC picks fall into groups that are consistent with the trap domains determined from the top Wabiskaw-McMurray reservoir restoration. The northeastern onlap trap has the shallowest restored BWC at 319 m (1046 ft) depth, followed by the central four-way anticline at 351 m (1151 ft), the southwestern trap domain at 366 m (1200 ft), and the northern trap domain at 393 m (1289 ft). The difference in these elevations is consistent with the conceptual charge model in which the central four-way anticline was filled first, followed by the northeastern onlap trap and then the peripheral trap domains that would have been sealed by immobile bitumen farther updip.

ALL DONE!

Thank you for listening, I know it was long, but its hard to present 19 pages of information in 10 minutes!