



Earth's physical resources: extracting coal & oil

Hidden oil reserves

Grant Mossop

Remember Goose River? These are the same rocks that we saw there in the sub-surfacing core: same age, Devonian; same faces, with these fragments of shells; pretty porous and permeable rock. But we've done those: we've come east from the basin, about 400 kilometres, here to the edge of the Great Devonian Basin in Alberta, to where the rocks come right to the surface. This rock doesn't contain any oil now, even though it is porous and permeable. But what we think happened is that the vast majority of the oil generated down there in the sub-surface, has migrated up dip and laterally and passed through these strata and been trapped just above me here in one of the great oil fields of the world, the Athabasca Oil Sands. Just around the corner up here and we'll go and have a look at it.

Narrator

The total area of the deposit is about the same as that of Wales. The estimated reserves of oil are approximately the same as in the whole of the Middle East. The oil sands are part of the lower Cretaceous McMurray formation, which is about 50 metres thick, and lies uncomfortably on the Devonian limestone's.

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This, then, is a natural exposure of the McMurray formation. The sands themselves are quartz rich, very fine grained to fine-grained, moderately well-sorted, really an excellent reservoir with porosity and permeability that's two or three times what's commonly it is in the conventional reservoir. The sands were deposited in what we interpret as a large channel system. Evidence such as these cross-beds which you see here with the laminae dipping off there towards the left, are indicative of flow in the bottoms of these channels along big bed forms migrating downstream, under conditions of current that allowed the sand to be deposited, but kept the silt and clay moving and in suspension, so that it resulted in a very clean and well-sorted reservoir. The evidence such as this, and the evidence higher up in the formation, gives us this idea then of a very large channel system, perhaps sourced as far south as Arizona and New Mexico, emptying into the sea just to the north of here. Well, the oil of course is saturating the sands here. What does that oil really look like? Here it is. The bitumen is an extremely stubborn, heavy, viscous, crude oil. It's immobile at reservoir temperature, and indeed it's only on hot days such as this that the heat from the sun is enough to allow the oil to bleed down off the surface, such as we see here. In the sand of course the oil is hosted between the quartz grains, just as it would be in any sand reservoir, but one of the really remarkable features of the oil sands is that you can pull it apart with your bare hands; it has virtually no cement.