U of A researcher discovers why Tibet 'roof of the world'

Planet's highest plateau sits on giant bed of molten rock

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Martyn Unsworth's research in Tibet is being published in a prominent science journal.

A University of Alberta geophysicist is helping explain how the Tibetan plateau — often called the roof of the world — became the Earth's largest and highest continental land mass.

Martyn Unsworth of the U of A and his research team from China, Canada and the U.S., found the plateau sits on a layer of molten rock deep in the earth's crust that acts like a big waterbed. The melted hot rock is less dense than the rock above it and, like hot air, it rises, slowly pushing up the plateau, much the way a hot-air balloon works, Unsworth said.

The work is published in this week's edition of the international journal *Science*.

Unsworth, a graduate of Cambridge University who first went to Tibet in 1995 and is returning there next week, said people have long debated the mechanism that created the Tibetan plateau. Most of it is 4,500 to 5,000 metres high, or as much as a kilometre higher than anything in the Canadian Rockies. Mount Robson, the Rockies' highest peak, is 3,954 metres.

The plateau and the Himalayas that ring its southern edge were created by the collision far beneath the earth's surface of the Indian and Asian plates, beginning about 40 million years ago.

The Indian plate is still moving north beneath the Asian plate at a rate of about five cm a year, Unsworth said.

"It hasn't slowed much as far as we can tell," he said. "There have been two consequences of that. One is that the Indian crust has been pushed into Tibet like a big pile of snow in front of a snowplow. And it appears that a large amount of the Asian crust is being pushed sideways."

What's unusual about the crust under Tibet is that it's 60 to 80 km thick, more than double the 30 to 35-km thickness of the crust under other continents.

As the crust thickened, it trapped more and more heat from natural radioactive decay of uranium in the crust. With a crust that's double the normal thickness, the heat can't escape quickly enough, Unsworth said.

Computer simulations show that such conditions can create temperatures of 600 to 700 degrees C within five to 10 million years. Crustal rock starts melting at 650 degrees.

And when it melts, it becomes a much better conductor of electricity than solid rock, a property Unsworth and his team used to make their findings. Along with standard oil-industry type seismic methods, they used special equipment to detect the small but measurable electric and magnetic fields in the earth.

They found the conductivity of the middle and lower crust under the Tibetan plateau was many times higher than that under typical continental crusts.

"We first saw this in the southern part of Tibet in '95, and virtually everywhere we've been since, all the way north about 1,000 km, we've seen it," Unsworth said.

Because of its unique situation, Tibet has long been considered a key location for scientists studying plate tectonics, he said.

But China, which invaded and annexed Tibet in 1958, had declared the area off-limits to Western scientists until the 1980s.

Unsworth first went there in 1995 after accepting a position with the University of Washington in Seattle. He went back in 1998 and 1999. He took his current position in the U of A physics department last July.

The team started in the southern end near the capital Lhasa in '95 and worked its way in subsequent trips northward through mostly roadless land.

"It's an intriguing place," Unsworth said. "You drive on these dirt tracks, and when it rains, you don't drive because the tracks get too slick. You drive with two vehicles, one of which has a winch and long cable and you never go out without a sleeping bag and plenty of food."