



# Rocking our world



Johnston

## A UVic researcher's theory about BC's geological origins may surprise you

by Peigi McGillivray

If you had lived in Kelowna 110 million years ago, the Pacific Ocean would be lapping at your door. That's because the rest of BC was up to 3,000 kilometres south of here—closer to Mexico than to Alberta.

That's the view of Dr. Stephen Johnston, a University of Victoria geologist and an expert in plate tectonics, who is working on one of the most complex geological puzzles in the world—how the western edge of North America was formed.

“Mountain ranges occur when one continent bumps into another, causing a ‘wrinkle’ in the land,” he says. “But the geology of the mountains of BC and Alberta looks more like a train derailment than a wrinkle. There are huge shards of land folded up against each other—and they contain mineral deposits unlike the surrounding land.”

Johnston believes this is evidence that what is now the western edge of North America was once a completely different continent—an 8,000 km-long, 500 km-wide ribbon of land that stretched from Siberia to Mexico, separated from North America by an oceanic basin.

This ribbon continent, which Johnston has named SAYBIA (for Siberia, Alaska, Yukon and BC) rested on the Pacific tectonic plate, which slowly moved north, sinking under the Eurasian plate and colliding with Siberia.

“As it collided, it buckled like a derailing train,” says Johnston. “The buckled part created Alaska, while a long unbuckled portion forms much of BC and the Yukon.”

Using clues found in rocks and fossils, Johnston is part jigsaw puzzler and part detective, driven by a deep curiosity about how the Earth system works.

To prove his SAYBIA theory—which remains controversial in geological circles—Johnston looks for evidence of a boundary between BC's exotic southern rocks and the “native” rocks of North America.

“We're finding that you can draw a line down the middle of the Rocky Mountains that separates North American rocks to the east, which were deposited on a quiet, passive continental edge, and rocks to the west, which were deposited in a volcanically active setting where the continents were colliding.”

One of the fascinating aspects of Johnston's

theory is the light it may shed on dinosaur distribution in North America.

“Alaska has produced some amazing dinosaur fossils,” says Johnston, “but they present an enigma. If Alaska had always been part of North America, those dinosaurs would have lived so far north that they would have been in complete darkness for six months of the year.”

A more likely explanation, he says, is that they lived on SAYBIA and their fossils were delivered to North America by plate movement long after they died.

“What we're just starting to look at is whether there might also have been an influx of new, living dinosaurs into North America while the continents were colliding—an invasion of dinosaurs that had cruised north on SAYBIA.”

Johnston's research has major implications for issues as diverse as mineral exploration, oil and gas development, paleontology, and climate change.

“Understanding how the geography of Earth has changed over time will help us determine the causes of climate change,” he says. “It's only by delving deep into Earth's past that we can plan thoughtfully for the future.”

### EDGEwise

Continents don't move very fast on a human time scale. Tectonic plates usually move only a few millimetres a year. It's only when there is too much pressure between plates that they suddenly slip and we notice an earthquake, as happened in Japan in March.

Johnston spends most summers collecting samples in the Rocky Mountains. He has also conducted studies in the mountain ranges of Europe, including the Alps of France and Italy, and the Variscides of Spain.

In addition to his work on ribbon continents, Johnston has introduced a new way to explain the bends in mountain belts and provided the first comprehensive tectonic model of North American mountain ranges.

Each year Johnston leads his geology students on an 11-day field school through the mountains of Alberta and BC to teach them how to develop their own interpretations of mountain geology. Their rock samples are added to a growing database on BC's early geological history.

UVic researchers were awarded nearly \$100 million in outside research grants and contracts in 2009/10—more than triple the amount achieved 10 years ago.



Supporting education in our community



*We're going places.*

University of Victoria Research