

How old are our mountains? It's not an easy question

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It would seem logical that something as tangible as the Sierra Nevada ought to have a relatively clear geologic history. Guess again. How old our mountains are, and what caused them to rise, remain uncertain and controversial subjects.

Determining the age of the Sierra's rocks has proven relatively easy. The granites that form the great majority of the Sierra here in Tulare County range in age from about 60 million to more than 150 million years. The rock gets younger as one moves east. In the Giant Forest and Lodgepole areas of Sequoia National Park, the granites average about 100 million years of age. Located adjacent to the Sierra's granites are older rocks. Laid down originally as layers of oceanic sediment along an arc of islands off what was then the western edge of North America, these badly distorted layers date from 150 million to nearly 400 million years ago. The reddish rocks that define the landscape in Mineral King Valley represent these rocks locally. The old sediments at Mineral King first accumulated on the bottom of the sea about 200 million years ago.

So that much is easy. But how old are the mountains themselves? Did the Sierra rise recently, within the past several million years, or is it much older?

Now we look for other kinds of evidence, and there is a great deal of it. Unfortunately, it contains many contradictions.

Surprisingly, one of the best places to search for evidence about the uplift of the Sierra is in the San Joaquin Valley, beneath which a huge geological record has accumulated.

The sediments that underlie the San Joaquin Valley document a long and complex saga. The "basement rocks" beneath the sediments in the eastern half of the valley date back about 120 million years. Above this layer, several vertical miles of sediments exist. Each layer documents a part of our Valley's geological history.

Along the eastern edge of the Valley, coarse-grained sediments have been accumulating for about 70 million years. This could only have happened if the terrain immediately to the east of the Valley was eroding westward. This means that there must have been uplands there of some sort. But were these uplifted areas similar to the modern Sierra?

Not necessarily. Another clue comes from the fact that we know that the San Joaquin River flowed westward from what is now the state of Nevada until about 3 million years ago. This fact

can be demonstrated by the presence west of the Sierra of river pebbles derived from rocks found east of the Sierra.

Does this mean that the Sierra was lower then, or was the country to the east significantly higher? Again, the arguments continue.

Locally, using yet another form of evidence, the uplift of the Sierra seems relatively recent. In the Kaweah River watershed, the rugged terrain and steep descent of the Kaweah's forks from their headwaters all suggest a young and quickly eroding landscape.

Last summer, however, yet another study, using yet another form of evidence, suggested that 50 million years ago, the northern Sierra was as high or even higher than it is today. But was that true of the southern end of the range as well? Who knows?

Confused? So are the scientists. Our mountains, it seems, have a surprisingly complex history that includes multiple episodes of uplift and erosion. But as studies continue, a consensus is building that the Sierra dates back a good deal further than we thought a few decades ago.

In some form, the Sierra has existed for many tens of millions of years. Today, the southern end of the range, much of it in Tulare County, rises very high. Powerful earthquakes, most recently in 1872, continue to torture the range's structure in ways that geologists still seek fully to understand.

The moral of all this, I believe, is that we live on an interesting but complicated planet. And therein lies the pleasure of paying attention to the natural world.

Three Rivers resident William Tweed writes about the natural world of Tulare County. His column, copyrighted and printed by permission, appears every other week in Living.