Tectonic plates act like variable thermostat

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Like a quilt that loses heat between squares, the earth's system of tectonic plates lets warmth out at every stitch.

But a new study in *PNAS Early Edition* finds the current blanket much improved over the leaky patchwork of 60 million years ago.

The study, appearing online the week of Aug. 13-17, shows that heat flowed out of Earth's mantle at a high rate 60 million years ago, when small tectonic plates made up the Pacific basin.

The reason, the authors said, is that much of the heat from the mantle escapes near the ridges between newly formed plates. Those areas are thinner and allow more heat to pass.

The smaller the plates, the greater the heat loss from the mantle on which they float, said geophysicists from the University of Southern California, Johns Hopkins University and the University of Michigan at Ann Arbor.

Several small plates have more area close to the ridge – and allow more heat to pass – than one large plate, explained lead author Thorsten Becker, assistant professor of earth sciences at USC.

"When you go back 60 million years there were a bunch more smaller plates in the Pacific basin," Becker said.

Using seafloor age reconstructions published last year, Becker and his co-

authors found that heat flow out of the mantle in the last 60 million years was greater than previously estimated.

They also found that heat flow is relatively low now that the Pacific basin consists mainly of one large plate.

Becker added that variations in heat flow would not necessarily affect surface temperature, which depends on many factors, including solar activity and greenhouse gases in the atmosphere.

However, Becker said, a leaky tectonic quilt on average would lead to greater volcanic activity, earthquakes and plate movement. This would affect almost every aspect of Earth's geography, from sea level to erosion to climate.

"There's sort of a chain of things that follows from a good mechanical understanding of how plate tectonics works," he said.

Like previous estimates of heat flow, the new study raises a nagging question. If heat loss for the past few billion years was comparable to Becker's estimate, the mantle would have had to be impossibly hot at the beginning of Earth's history.

Becker's study, which implies an even greater rate of heat loss, shows that previous models designed to avert a "thermal catastrophe" do not work.

"A different solution to the thermal catastrophe needs to be found," he said.

Source: University of Southern California