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Does Singapore have active faults? Geomorphic and sedimentological investigations in an urbanized tropical city–state

Aron J. Meltzner[1,2], Liam L. Newman[1], Wanxin Huang[1], Matthew Xiang Hua Foo[1], and Mason K. Perry[2]

[1]Asian School of the Environment, Nanyang Technological University, Singapore
[2]Earth Observatory of Singapore, Nanyang Technological University, Singapore

Singapore, a highly urbanized city–state of 6 million on a ~730 km^2 island, is commonly believed to be "safe" from local earthquakes, with only distant Sumatran earthquakes thought to affect it. This view likely arises from the scarcity of recorded local events since Singapore's founding in 1824, yet it overlooks two $M \geq 5$ earthquakes within ~120 km to the north and northwest in 1922, and a 1948 event — reported only from the island's southern–central area — that produced EMS intensity IV–V at multiple closely spaced sites, suggesting $M \approx 4$ with a local source. Recent mapping has revealed numerous bedrock faults in Singapore, but their capability remains unstudied.

The Downtown Core of Singapore, in the southern–central part of the island, is built atop the low-lying Kallang Basin and adjacent reclaimed land. Sediments, likely MIS 5e (120 ka) and younger, fill the basin to 40 m depth in the west but thin eastward; immediately to the west, Cretaceous to Pliocene bedrock rises up to 50 m above sea level. The steep, unconformable contact between bedrock and overlying layers has been interpreted as either a sea cliff or an inactive fault. We hypothesize instead that it may be an active fault — part of a transtensional stepover in a longer dextral fault system.

Using five decades of legacy borehole data, we are mapping the subsurface architecture of Kallang Basin and drainages to the west. The thalwegs of at least two east-flowing buried paleochannels abruptly drop more than 10 m eastward near the topographic step, and they both appear to shift several hundred meters southward, though resolution is limited by available borehole data. Could this be explained by channel meanders and knickpoint migration, or does it implicate right-lateral transtensional displacement after the two paleochannels were incised? We are extending the investigation to nearby paleochannels to address this question.