

Digging for Lost Rivers in Thailand: Locating and Dating Paleochannels in the Chiang Mai Intermontane Basin

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The drainage of the Chiang Mai basin has a dynamic but largely forgotten history. In the late 1980s, an ancient lost city was excavated near the Ping River in Chiang Mai, Thailand. Archaeologists had unearthed Wiang Kum Kam, the former royal capital of the Lanna Civilisation founded in 1286 CE. Former investigations revealed that flood sediments buried the capital and remnants of an abandoned river channel were discovered beneath the surface. This concurs with historical descriptions of the Ping River being on the eastern bank of the capital, despite being presently located on the western bank. The paleochannel drained 500 years ago after diverting west of the ancient city. This switch, an avulsion, coincided with a large flood, which could have triggered and/or caused the avulsion. Local oral histories also recount other Ping avulsions across the basin, but these were not documented. Some of these paleochannels residually remain as unusually sinuous irrigation canals, with historically suggestive names such as the Old Ping and the Small Ping Rivers. Here, the geomorphological evolution of the Ping River is investigated, as a future avulsion in this extensively populated area would be catastrophic.

Evidence shows that the drainage of the Chiang Mai basin evolved from a braided system, to an avulsing anastomosing system, to a primarily single channel system. Two-dimensional electrical resistivity tomography and augering detected a large continuous body of fluvial sand ~ 4 m below the surface, across the 10 km distance between the Ping and Kuang Rivers. This sand continues to the depth of at least 30 m and is typical of a braided system. Further augering along paleochannels revealed buried levees that protrude from the braided river deposits to near the surface, separated by fine floodplain sediments. This may have formed as the braided system evolved into an anastomosing system, where distinct channels stabilised and floodplain deposits could develop between channels. These paleochannels were eventually abandoned through avulsion, decreased significantly in size, and were converted into irrigation canals with settlement.

Thirty-five sediment samples were dated using optically stimulated luminescence (OSL) and accelerator mass spectrometry radiocarbon dating. Sediments from within the upper braided deposits were 40,000 years old and the transition to an anastomosing system occurred 3,000 years ago. Age estimates and the spatial pattern of the paleochannels indicate that the Ping River has sequentially avulsed at least 5 times in approximately 600 years, from the east to 10 km west where the Ping River is currently located. The most recent avulsion occurred about 200 years ago, from a paleochannel 2.2 km east of the present Ping. This pattern of migration is reminiscent of basinal tilting resulting from the basin's west-east extending half-graben structure. It is possible that tilting increases channel instability and then large floods and/or earthquakes trigger avulsions. If so, future avulsions are conceivable. In addition to standard luminescence dating procedures, a new method of applying pulsed OSL was also explored to distinguish quartz and feldspar signals for more accurate age results.