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Determining the accumulated offset of a dormant oblique transform fault by edge-related rotations

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The long-term kinematics of transform faults is often poorly resolved due to the lack of appropriate geological and geophysical markers. Yet, prominent displacements accommodated by the faults generate vertical-axis rotations in the upper crust that confine the edges and bends of the faults. These rotations are found outside of the fault zone and are not related to any large-scale block rotations and were thus far mostly ignored. Here we present paleomagnetic mapping of the vertical-axis rotational field in southern Israel, along the late Cretaceous Ramon Fault, an oblique strike-slip fault that although extensively studied, its horizontal offset is still not well known. We create a series of simple elastic dislocation slip models that are based on the structural setting of the fault, in order to quantify its cumulative long-term slip. The rotations predicted by the models best fit the observed rotation field when 1.5 ± 1.5 km of horizontal offset is used. This method can potentially be applied to the study of the kinematics and mechanical behavior of other transform faults.