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Challenge in identifying and characterizing active faults in low deformation area. Example near the capital of Mongolia.

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The detection of active fault in low deformation area is a challenge as, most of times, the morphology has been smoothed and the seismic activity is too low to suggest their presence. Nevertheless, it becomes a necessity when there are important or strategic issues in the area. We focussed our work in the area of the Capital of Mongolia where half of the population of the country is living. Despite the country suffered four magnitude 8+ during the last century, the rate of deformation along these large faults, located in the western part of the country, is about 1mm/year with recurrence time of several millenaries. Near the capital, Ulaanbaatar, the rate of deformation appears much smaller, under the mm/year and, and until recent time only one important fault was identified. No important earthquake is known in the area. We detected 2 new active faults (Sharkhai and Avdar) at less than 35 km from the city and 10 km from the new airport. We applied morpho-tectonic, geomorphological and paleoseismological approaches using high resolution images and field investigations to map the faults in details, describe their geometry and segmentation, identify their kinematic, document their seismic behavior (co-seismic and cumulated displacements, age of the last earthquakes and slip rate). The Sharkhai and Avdar left lateral strike slip faults fault extend each about 46 km. Despite a weak surface morphology, we observed important deformation in the trench opened across the Sharkhai fault. We identified three earthquakes giving a minimum return period of strong earthquakes of 1195 $\pm$ 157 years. But the co-seismic displacement is still under question, and following the various hypotheses, the maximum slip rate is between 0.6$\pm$0.2 and 2.14$\pm$0.5 mm/year. Depending of the segmentation scenarios used, the fault can produce earthquakes of magnitude 6 to 7. The estimated peak ground acceleration at rock for the nearest issues is between 0.1g (Ulaanbaatar) and 0.3g (new airport), value that has to be increased on the sedimentary sites. Outside regional particularities (cryoturbation, rare carbon contains in sediments) we had the advantage of a region with no human impact allowing the detection of the fault. It shows that in a region with low deformation rate, large active faults can still be undetected especially if the last event happened several millenaries ago. These faults could nevertheless have an important contribution in the hazard as they already accumulated significant deformation.