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Rupture mechanism via surface cracks: the October 1, 1995 Dinar earthquake (M_w=6.2), SW Turkey

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A moderate earthquake (M_w=6.2) caused substantial damage in the town of Dinar (Afyon, SW Turkey) at 17:57 UT, on October 1, 1995. Surface rupture was observed to be discontinuous for 10 km along the NW-trending Dinar fault and consisted of up to several tens of meters long and a meter wide nearly vertical cracks that exhibited linear, sigmoidal and anastomosing geometries. Most of these cracks displayed a dip-slip component of displacement (0.05-0.6 m); those with anastomosing geometries indicated a large dip-slip ($>$0.25 m). Sigmoidal crack patterns showed both right and left strike-slip component of displacement and a small dip-slip ($<$0.25 m).

The geometry of the cracks and related modes of slip suggest a 325° oriented horizontal principal stress direction. This direction makes an acute angle with the NW-trending plane of the Dinar fault. This acute angular difference is related to complex fault geometry and faulting manifested in the surface rupture and indicated by the focal mechanism solution of the earthquake. Under the influence of this horizontal principal stress direction of compression, firstly en echelon sigmoidal cracks were formed by strike-slip movement on the Dinar fault. Then, these cracks were modified by a predominantly dip-slip movement on the fault plane; the initial cracks were connected to each other by anastomosing cracks of a second rotational phase. The rotation led the hanging-wall block of the Dinar fault to depart from its predominantly normal dip-slip orientation to an oblique southwesterly direction towards the Mediterranean Sea as suggested by strike-and dip-slip indicating cracks.