Rock failure propagation since last glacial age (10kyears) in the south-eastern French Alps : the La Clapiere Deep Seated Landslide

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The "La Clapière" area (Tinée valley, Alpes Maritimes, France) is a typical large, complex, unstable rock slope affected by Deep Seated Gravitational Slope Deformations (DGSD) with tension cracks, scarps, and a 60×10^6 m^3 rock slide at the slope foot that is currently active. The slope surface displacements since 10 ka were estimated from ^{10}Be ages of slope gravitational features and from morpho-structural analyses. It appears that tensile cracks with a strike perpendicular to the main orientation of the slope were first triggered by the gravitational reactivation of pre-existing tectonic faults in the slope. A progressive shearing of the cracks then occurred until the failure of a large rock mass at the foot of the slope. By comparing apertures, variations and changes in direction between cracks of different ages, three phases of slope surface displacement were identified: 1) an initial slow slope deformation, spreading from the foot to the top, characterized by an average displacement rate of 4 mm yr^{-1}, from 10–5.6 ka BP; 2) an increase in the average displacement rate from 13 to 30 mm yr^{-1} from the foot to the middle of the slope, until 3.6 ka BP; and 3) development of a large failure at the foot of the slope with fast displacement rates exceeding 80 mm yr^{-1} for the last 50 years. The main finding of this study is that such a large fractured slope destabilization had a very slow displacement rate for thousands of years but was followed by a recent acceleration. The results obtained agree with several previous studies, indicating that in-situ monitoring of creep of a fractured rock slope may be useful for predicting the time and place of a rapid failure.