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Landslides in the Tovel Valley: shaping the landscape and ruling the people

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Landslides are very efficient in shaping mountain landscapes, modifying the drainage pattern of the valleys, forcing people to adapt, react or counter them. In particular, valleys in the southern side of the Alps are narrow, with very steep slopes, and often have been inhabited since prehistoric times.

The Tovel Valley is located in the Adamello Brenta Nature Park in the northern Brenta Dolomites, near a lake (Tovel lake) that is famous for its, at times, red colour. This valley can be found in the central-eastern Southern Alps, along the western margin of the Adriatic indenter. Here, tectonic forces started to act in the Late Cretaceous, during the initial phases of the Alpine orogenic history, and are still active today. Moreover, the Trentino Region is one of the most seismically active sectors of Northern Italy, with significant historical and instrumental earthquakes typically clustered in very good agreement with tectonic structures. N-S oriented vertical strike-slip faults determined the shape of the Tovel Valley, favouring the occurrence of prominent source detachment scarps on the eastern valley side. The Tovel lake, whose origin is still debated if due to glacial processes or landslide events, records a sudden rise in its level, testified by the drowning of a submerged forest dated by dendrochronology at 1597 AD. This event is interpreted as due to a minor rockfall, which blocked the outflow channel on the north-eastern lakeside. This event had direct consequences on people living in the area, that were forced to find timber elsewhere, but also older, and larger, rock avalanches likely affected people living in the valley.

Whilst Tovel lake has been studied for a long time, the blocky deposits of the Tovel Valley gathered much less attention. By means of field mapping, remote sensing and cosmogenic ^{36}Cl exposure dating, we reconstruct the age and the evolution of the blocky deposits that occupy large areas of the valley bottom, with implications directly connected to the formation and evolution of the Tovel lake. Landslide deposits cover an area of ~5 km^2 and are composed of seven bodies distributed at different elevations, ranging from ~1900 to ~900 m a.s.l. Their total volume is estimated at 200–280 Mm^3 of debris made of Dolomia Principale and Calcare di Zu Formations. Detachment areas are mainly located along the eastern valley side, with six out of seven events that can be classified as rock avalanches.