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Impact of historical landslides on natural landscape and human settlements in the core of the Alps: the Piuro 1618 disaster in the Bregaglia Valley.

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Natural disasters, such as postglacial landslides in Alpine valleys, recurrently reshape the natural and human landscape, impacting on settlements, land-use and architecture. Historical catastrophes were sometimes narrated and painted, so that in these cases chronicles and artistic representations can be integrated to geological, geomorphological, geophysical and archaeological data to describe the co-evolution of the natural and cultural landscape. This is the case of the Piuro landslide that in 1618 almost completely buried this renowned and rich trading town in the Bregaglia Valley (Italy), on the way to the relevant alpine Maloja pass. Since it totally modified the valley floor, the catastrophe represents a turning point that permits to i) attempt the 3D reconstruction of the natural and archaeological landscape before and immediately after the disaster, ii) unravel the post-1618 increments of evolution of the natural landscape and settlements, iii) retrieve the memory of the area that underwent the disaster. To accomplish these aims we integrated: a new detailed DTM; a reconstruction of the relative chronology of burial, erosion and stabilization of the landforms after natural and anthropic processes pre- and post-dating the 1618 landslide; some subsurface stratigraphic logs and images based on new boreholes and geophysical surveys; age determinations based on radiocarbon and archeological/historical data; chronicles and paintings depicting the Piuro area before and after the disaster. The images we could draw show how human settlements were continuously controlled by the occurrence of landslides and other catastrophic processes like debris flows, before and after the 1618 landscape turning point. In the valley center we could detect a pre-1618 landslide body, whose mega-boulder reliefs were settled at least since the 4th – 5th century AD, at present buried below the Middle-ages and Renaissance Piuro villages. These landslide bodies provided also favorable settings for food preservation, whose memory and usage survived and reached the present-day under the vernacular denomination of “crotti”. At the millennial time scale no stable geomorphological surfaces do exist on the valley floor and lower slopes, since we could map the chronology of building of the debris flow-fan lobes, demonstrating how they evolved before and after the 1618 landslide, burying and/or being buried by the two major landslide bodies and interfingering with the trunk river alluvial sediments. Radiocarbon age determinations, archeological findings and the known ages of historical buildings permitted to recognize the geomorphological surfaces that remained stable on a shorter, secular, time scale, where the settlements could resume still

competing with catastrophic processes that led to repetitive burial of several buildings during the last three centuries. Based on these results we could draw the 3D models of the Piuro area predating and immediately postdating the 1618 catastrophe. Historical paintings and chronicles largely confirm the relative chronology of landscape changes that we propose.

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