The wide historical Becca France landslide occurred at dawn on July 6th, 1564. It involved the Becca France ridge (2313 m a.s.l.) a few kilometers NW of the town of Aosta (Aosta Valley, NW Italy). This event buried the Clusellaz Valley floor (a Dora Baltea left tributary) destroying the populous ancient village of Thora and resulting in an unknown number of victims (120-545). The occurrence of this landslide is documented in the local historical literature. Despite this, the geological and morphological features of the accumulation have never been investigated. The aim of this work is to map the geological context of the area affected by the gravitational event, to reconstruct the phenomenon and to make a first evaluation of the causes of the landslide. The examined area is located along the contact between the Middle Penninic and the Piedmont Zone. The geological survey has allowed to distinguish, above the tectonically deeper continental unit (Gran San Bernardo Nappe system), two oceanic units (Lower and Upper TMU of the Aouilletta Unit). This area was largely interested by the Pleistocene glaciers and by a wide deep-seated gravitational slope deformation (P. Leysser DSGSD). The detachment niche extends in the right side of the Clusellaz Valley and is shaped in the E slope of the Becca France ridge. It corresponds to a very steep cirque-like scarp, very remarkable for its width (about 850 m), height (more than 500 m) and the lack of vegetation cover. It consists of two calcischist units (the lower one with prasinite) separated by a tectonic contact underlain by cagneule and gypsum. The niche cuts the doubled Becca France ridges and other gravitational evidence of the P. Leysser DSGSD. The landslide accumulation, some tens of meters thick, also exhibits a wide extent (about 1.26 km²). It climbed for about 80 m on the opposite side of the valley. The landslide body partially developed immediately below the detachment niche (proximal sector) is probably connected to a rockfall. Most of the accumulation is lengthened for approximately 3 km into the Clusellaz Valley floor (middle-distal sector), showing several longitudinal ridges, up to ten meters high and some hundreds meters long. This sector, having travelled down the slope a long distance, is an example of a landslide body with longitudinal ridges, linked to a rock avalanche. The slope failure was triggered by the concurrence of various predisposing causes: i) the sufficiently strong relief energy, with difference of level of 700 m between the mountain crest and the glacially-deepened valley floor; ii) the fractured and slackened bedrock connected to the DSGSD; iii) the poor geomechanical properties of the outcropping calcischist; iv) the chemical dissolution of cagneule and gypsum along the tectonic contact between the two calcischist units. An interval of extremely heavy rainfall, that produced an increase in interstitial pressure, was probably the triggering cause.

Keywords: rock avalanche, DSGSD, Aosta Valley, Becca France.

1. INTRODUCTION

The Becca France historical landslide is known in the Aosta Valley local literature as the worst natural disaster causing victims of the region. It developed in the tributary Clusellaz Valley, a few kilometers NW of the town of Aosta (Fig. 1). Nevertheless, the geological features of the landslide body (distribution, thickness, morphology and petrographic composition) and of the detachment niche (extent, morphology, gradient, lithology and fracturing) have never been investigated and described in detail.

The geological context of the area involved in the event has now been studied. It includes a geological mapping of the Becca France sector (see Fig. 6) and a first evaluation of the landslide’s predisposing causes. The link with the Pointe Leysser deep-seated gravitational slope deformation (P. Leysser DSGSD), a very extensive gravitational phenomenon, is particularly investigated.

The local historical literature has described the wide landslide that occurred at dawn on July 6th, 1564, as coming from the eastern slope of the Becca France ridge (Cerutti et al., 1993). The landslide accumulation quickly buried the ancient village of Thora, described as a nice place located in the Clusellaz Valley floor. Currently, a new village (named Thouraz) occurs 1 km SE from the possible location of the ancient village. This ancient village was very important for its residential population (52 families) and its commercial activities (10 watermills and 14 weaving factories) (Fénoil, 1983), although the accuracy of these data is disputed (Caniggia et al., 1999). The first remarks about the disaster occur in some administrative acts (dated to 1565, 1576, 1581 and 1583), reporting a different number of victims (545 according to the inhabitants and 120 according to the authorities). These acts include a request for compensation for the victims and the landslide damage (loss of wood, vines and the Ville-sur-Sarre irrigation canal) (references in Bollati, 1988). An old memorial plaque preserved in the Parish Church of Sarre, containing the landslide date, is mentioned in Caniggia et al. (1999). Fénoil (1883) also relates a catastrophic flood in the T. Clusellaz during the 1566. On June 10th, 1851 another significant alluvial event ravaged the Sarre Parish House garden on the Clusellaz fan (Caniggia et al., 1999).