THE AD 1881 EARTHQUAKE-TRIGGERED SLUMP AND LATE HOLOCENE FLOOD-INDUCED TURBIDITES FROM PROGLACIAL LAKE BRAMANT, WESTERN FRENCH ALPS

H. GUYARD [a, b], G. ST-ONGE [a, b], E. CHAPRON [c], F. S. ANSELMETTI [c], P. FRANCUS [d, b]

[a.] *Institut des Sciences de la Mer (ISMER) à Rimouski, Université du Québec à Rimouski, 310 allée des Ursulines, Rimouski, Québec, Canada, G5L3AI*
[b.] *GEOTOP-UQAM-McGill, C.P. 8888, Succursale Centre-ville, Montréal, Québec, Canada, H3C 3P8*
[c.] *Geological Institute ETH Zürich, Universitätstrasse 16, CH-8092 Zürich, Switzerland*
[d.] *Institut National de la Recherche Scientifique- Eau, Terre, et Environnement (INRS-ETE), 490 de la Couronne, Québec, Québec Canada, G1K 9A9*

Abstract

High-resolution seismic analyses on the sedimentary subsurface of the deep basin of proglacial Lake Bramant (Grandes Rousses Massif, Western French Alps) allowed the detection of a large lens-shaped body with chaotic internal reflections corresponding to a mass wasting deposit (MWD) triggered by the nearby AD 1881 Allemond earthquake (MSK intensity VII). This MWD was only retrieved at the base of a short gravity core and the top of a piston core. Sediments associated with this MWD are remoulded and laminated. Locally, blocks of sediment have preserved the original stratification. This earthquake-induced mass movement is an example of a slide that evolved into a slump. In addition, several Late Holocene turbidite and hyperpycnal deposits related to exceptional flood events were identified using high-resolution sedimentological, physical and geochemical analyses. However, the identification of hyperpycnites is sometimes complicated as erosion of the basal sequence can occur during the rising limb of the flood. While the precise dating of the oldest flood event is still ongoing, two flood events are coeval with the St. Sorlin glacier retreat following the end of the "Little Ice Age", suggesting outbursts of temporary ice contact lakes or subglacial lakes during warmer periods.

Keywords: slump, earthquake, hyperpycnites, turbidites, floods, proglacial lake, Western French Alps

1. Introduction

In lacustrine systems, mass wasting deposits such as slumps or turbidites can be generated by processes such as lake level change or slope overloading, but are more often triggered by the regional seismo-tectonic activity (Sims, 1975; Doig, 1986), especially in the Alpine region (Chapron et al., 1999; Schnellmann et al., 2002; Monecke et al., 2004; Nomade et al., 2005; Strasser et al., 2006). In addition, several major historic floods were previously recorded in Alpine lake sediments and were associated with hyperpycnal flows (Arnaud et al., 2002; Schneider et al., 2004). Hyperpycnal deposits (hyperpycnites) are characterized by the development of a coarsening-up basal unit during the increasing discharge period (up to the peak of the flood) and by a fining upward top unit during the decreasing discharge period (from the peak of the flood) (Mulder et al., 2001a, 2003; St-Onge et al., 2004; Chapron et al., 2006; St-Onge and Lajeunesse, this book). In proglacial environments, they can be deposited after the

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