Marine Geology 356 (2014) 1–4

Contents lists available at ScienceDirect

Marine Geology

journal homepage: www.elsevier.com/locate/margeo

Mass-transport deposits, olistostromes and soft-sediment deformation in modern and ancient continental margins, and associated natural hazards

Andrea Festa [a], Yildirim Dilek [b], Hans-Juergen Gawlick [c], Sigrid Missoni [c]

[a] Dipartimento di Scienze della Terra, Università di Torino, Via Valperga Caluso 35, 10125 Torino, Italy
[b] Department of Geology and Environmental Earth Science, Miami University, Oxford, OH 45056, USA
[c] Department of Applied Geosciences and Geophysics, Montanuniversitaet Leoben, Leoben, Austria

Mass-transport deposits (MTDs), olistostromes and related soft-sediment deformation structures represent significant components of the geological architecture of both modern and ancient continental margins, including active, passive and hybrid margin types (Dilek and Rowland, 1993; Stoker et al., 1998; Dilek and Robinson, 2003; Lamarche et al., 2008; Madon, 2010; Ratzov et al., 2010; Anma et al., 2011; Pini et al., 2012; Festa et al., 2013), and are commonly associated with earthquakes and tsunamis (e.g., Tappin et al., 2008). These tsunamic events adversely affected the human populations, engineering infrastructures and global economy, and inflicted severe and locally irrecoverable damages on the coastal ecosystems (e.g., Yamada et al., 2012 and references therein).

Improving our understanding of the mechanisms and processes of slope failure and MTD development, their spatial and temporal relationships with seismic events, and the dynamic equilibrium of active, passive and hybrid continental margins is one of the most urgent and challenging tasks faced by modern Earth science. To that end, a key approach to increase our scientific knowledge on these topics of both great scientific and societal importance is a comparative analysis of modern and ancient examples of MTDs, chaotic rock bodies and olistostromes (sensu Flores, 1955 or "sedimentary mélanges" sensu Bettelli and Panini, 1985; Festa et al., 2012), and the processes of their formation.

Interdisciplinary investigations in the last 30 years of modern passive and active continental margins through 3D-seismic reflection, multibeam sonar and submersible studies (including drilling, coring and in situ sampling) and analogue modeling played a major role in our comprehension of the mode, nature and scale of the formation of modern submarine MTDs with respect to their causative events. On the other hand, on-land studies of exhumed, ancient MTDs (or olistostromes) have provided useful information on their internal structure and stratigraphy at scales (meters to hundreds of meter) that are commonly difficult to obtain through marine studies mainly because of poor acoustic transparency below the standard seismic resolution. Hence, studies of modern and ancient MTDs/olistostromes are highly complementary and essential.

Olistostromes represent, in fact, excellent fossil examples of modern submarine MTDs (see Pini et al., 2012), produced by different types of gravity–mass movements, such-as block slides, debris avalanches and debris flow, and hyperconcentrated flows (Lucente and Pini, 2008). Recent studies of some large-scale chaotic bodies exposed on land that originated by en-mass gravitational processes, including olistostromes and sedimentary mélanges (see, e.g., Alonso et al., 2006; Callot et al., 2008; Burg et al., 2008; Lucente and Pini, 2008; Camerlenghi and Pini, 2009; Festa et al., 2010, 2012; Remitti et al., 2011; Wakabayashi and Dilek, 2011; Codegone et al., 2012a, 2012b; Dilek et al., 2012; Pini et al., 2012), have shown that these fossil MTDs are comparable in size and style to some of the largest modern submarine landslides documented in the literature. Comparison of modern (offshore) and ancient (on-land) examples of MTDs is thus fundamental not only to better understand their formation, but also to develop more effective countermeasures to mitigate their tremendous humanitarian and economic impact.

This Special Issue has emanated from two successful scientific sessions on the occurrence of modern and ancient MTDs, olistostromes and mélange formation, and related natural hazards that we convened at the American Geophysical Union Fall Meeting in San Francisco, California, in December 2011, and at the International Association of Sedimentologists (IAS) meeting in Schladming (Austria), in September 2012. The papers in this Special Issue present the most up-to-date observations and interpretations from a series of case studies on MTDs, olistostromes and related soft-sediment deformation structures. The geographic distribution of these examples is shown in Fig. 1. The papers include field-based structural, sedimentological, geophysical, deep-ocean drilling, and submersible studies of different modern and ancient continental margins. We thank Marine Geology for relaxing their policy on not publishing papers on rocks outcropping on land, so that this Special Issue can examine the relationship between the terrestrial and marine examples.

We have organized the papers in this Special Issue in two sections on modern (offshore) and ancient (on-land) MTDs and different processes of their formation. The first part includes four papers documenting some modern examples of MTDs, their internal structures, processes and mechanisms of their emplacement, and their role in triggering tsunami. The second part includes five case studies of ancient, on-land examples of MTDs (or olistostromes), which are closely comparable in

E-mail addresses: andrea.festa@unito.it (A. Festa), dileky@miamioh.edu (Y. Dilek), Hans-Juergen.Gawlick@unileoben.ac.at (H.-J. Gawlick), sigrid.missoni@unileoben.ac.at (S. Missoni).

http://dx.doi.org/10.1016/j.margeo.2014.09.001
0025-3227/