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Preface

Chaos and geodynamics: Mélanges, mélange-forming processes and their significance in the geological record

Mélanges occur extensively in accretionary and collisional orogenic belts around the world, and represent disrupted and chaotic units including sedimentary, magmatic and metamorphic rocks (commonly as exotic blocks) mixed by stratal disruption and tectonic, diapiric and/or sedimentary processes (Cowan, 1985; Festa et al., 2010; Horton and Rast, 1989; Hsü, 1968; Raymond, 1984; Silver and Beutner, 1980). Although numerous papers and books have been published on mélanges, the definition and the geological significance of mélanges are still a matter of debate and controversy. The mechanisms that are responsible for the formation of mélanges may occur in a range of geological environments from the shallowest geosphere to significant crustal depths, associated with subduction zone tectonics, en-mass sedimentary processes, slope tectonics, *in situ* fluidization and mud diapirism, strike-slip tectonics, or due to the interplay of some of these processes (Barber and Brown, 1988; Cloos and Shreve, 1988a,b; Festa, 2011; Festa et al., 2010; Harris et al., 1998; Huang et al., 2008; Maltman and Bolton, 2003; Marroni and Pandolfi, 2001; Meschede et al., 1999; Naylor, 1982; Osozawa et al., 2011; Pini et al., 2012; Swarbick and Naylor, 1980; Wakabayashi and Dilek, 2011; Yamamoto et al., 2012).

Although mélanges may characterize diverse geodynamic environments of formation, they are commonly associated with subduction of oceanic lithosphere, collisional events (arc-continent and continent-continent), and intra-continental deformation including rifting and passive margin evolution (Alonso et al., 2008; Dilek, 2006; Festa et al., 2010). Hence, mélanges are cogenetic with emplacement of ophiolites, advancement of thrust and nappe sheets, evolution of foreland basins, formation of submarine landslides (olistostromes) and seismic events (Festa et al., 2010). Mélange formation is also involved in the mechanical stability of accretionary and orogenic wedges, and in the redistribution of earth materials through the processes of offscraping, underplating, mass-transport movements, subduction channel flow, and mud diapirism (Ogawa, 1998; Shreve and Cloos, 1986; Vannucchi and Bettelli, 2002; Von Huene et al., 2004). Therefore, mélanges and mélange-forming processes are intimately linked with tectonics and tectonically induced geological processes in crustal evolution, and they constitute a significant component of the Earth history. Hence, further systematic and process-oriented, inter-disciplinary studies of mélanges should provide much-needed information about orogenic processes and crustal growth. Furthermore, the results of these mélange studies should also be most insightful for the recognition of these chaotic rock bodies in the Precambrian greenstone belts (Dilek and Ahmed, 2003; Dilek and Polat, 2008; Polat et al., 2008).

This Special Issue is a result of series of scientific sessions on mélanges that we convened at the GSA Global Meeting, *TECTONIC CROSSROADS*, held in Ankara, Turkey in October 2010, the European Geosciences Union General Assembly in Vienna, Austria in May 2010, and the American Geophysical Union Fall Meeting in San Francisco, California, in December 2011. The papers in this Special Issue present the most up-to-date observations and interpretations on various mélange types and mélange forming processes from around the world. The geographic locations of the mélanges covered in this Special Issue are shown in Fig. 1. This Special Issue makes a significant contribution to the mélange concept, streamlines the definitions and classifications of mélanges and broken formations, and provides a rich archive of well-documented mélange occurrences from diverse geological environments.

We have organized the papers in this Special Issue in six sections, presenting some case studies of various mélange types and different processes of their formation. It is important to note, however, that there are obviously some overlaps among these sections in terms of the mélange types and the related processes described. The first part contains a lead paper providing a new classification of mélanges and broken formations. The next section includes five papers that document the internal structure of the Shimanto accretionary complex and different fabric elements, physical properties and tectonic evolution of various mélange types in this classical accretionary complex. The following part comprises five papers involving mélanges that experienced high-pressure metamorphism and deformation in ancient subduction zones; the special focus here is placed on the Franciscan Complex of California. The next section contains five papers that emphasize the significance of sedimentary and diapiric processes in mélange formation. Olistostromal mélanges and the processes involved in their formation make up the topic of Part V. The last section contains four papers documenting different case studies of ophiolitic mélanges and the significance of these mélanges for the tectonic construction of the orogenic belts involved.

We thank the contributors to this Special Issue for their time and effort, and express our sincere gratitude to a large number of scientists who provided valuable and timely reviews of the papers in it. We also extend our thanks to the Editor-in-Chief, Dr. Fabrizio Storti, for his editorial help and guidance during the preparation of this special issue, and to the Elsevier staff in the *Tectonophysics* journal office.

1. Part-I: new classification of mélanges and broken formations

The term mélange and the mélange concept have evolved significantly since the first use of this term by Edmund Greenly for the Gwna Group of the Mona Complex in Anglesey in North Wales (Greenly, 1919). How mélanges form is still a lively topic of discussion. Thus, a contemporary approach, scrutinizing the historical account of the definition of mélanges and interpreting the mélange terminology is a timely effort. To this end, Festa et al. present a redefinition of mélanges and broken formations and discuss the main mechanisms and processes of stratal disruption and mixing in their development. The authors argue

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