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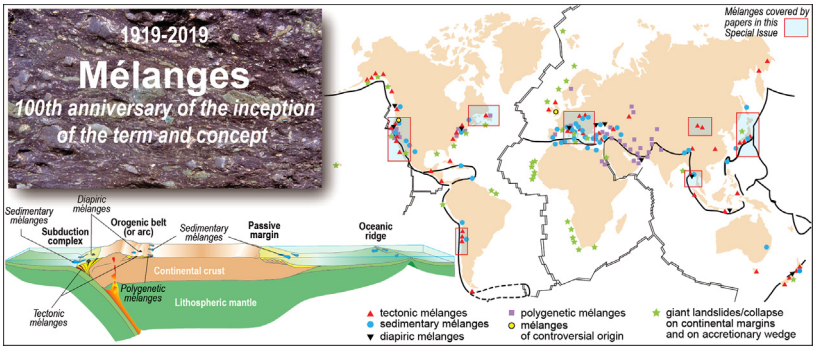
Mélanges: 100th anniversary of the inception of the term and concept

Graphical abstract:



One hundred years ago, in 1919, the British geologist Edward Greenly coined the term "mélange", abbreviation of "*autoclastic mélange*", in describing a tectonically disrupted and internally strained phyllite-sandstone succession in the Mona Complex (Gwna Group) in Anglesey, north Wales (Greenly, 1919). This term refers to a "*lenticular strips and lumps of grit floating in a schistose matrix*" given by progressive up to complete disruption of a stratigraphic succession, differentiating these rocks from other "chaotic" units originated by sedimentary-gravitative processes (e.g., the *Wildflysch Auct.*, largely described in the Alps after Kaufmann; in Studer, 1872; Kaufmann, 1886). Since this first definition, and after Hsü (1968), the term "mélange" has been extensively used to describe the occurrence of chaotic rock assemblages in orogenic belts and ancient subduction-accretion complexes, and later extended to other geodynamic environments such as collisional and intra-continental tectonic settings, including rifting and passive margin evolution, and strike-slip tectonic settings (see Camerlenghi and Pini, 2009; Festa et al., 2010 and reference therein).

The classical descriptive and non-genetic definition of a "mélange" refers to a mappable unit (at 1:25,000 or smaller scale) or body of internally disrupted and mixed rocks in, or rarely without, a pervasively deformed matrix (see Berkland et al., 1972; Wood, 1974; Silver and Beutner, 1980; Raymond, 1984; Cowan, 1985). Nonetheless this definition is largely accepted by "mélange workers", the occurrence of a large number of different types of chaotic rock unit worldwide formed by different processes (tectonic, gravitational, diapiric and their mutual interplay and superposition), and the lack of agreement on its formal implementation (e.g., Silver and Beutner, 1980; Rast and Horton, 1989; also compare Şengör, 2003 with Pini, 1999; Cowan and Pini, 2001; Festa et al., 2010; Wakabayashi, 2011), have led to some confusion and misinterpretations in the literature. This problem particularly concerns students and researchers in the broad field of geosciences who are not intimately familiar with mélanges, terminology, and inherent issues (e.g., complex internal structures and superposed origins of mélanges). In fact, in most orogenic belts and exhumed subduction–accretion complexes, a strong morphological convergence of meso- to map-scale fabric elements exists between a block-in-matrix fabric of basin-wide sedimentary (i.e., olistostromes and/or mass transport deposits), diapiric, tectonic, and polygenetic mélanges. This resemblance is the main reason of the long-standing debate on the nature and mode of geological processes that lead to the formation of chaotic rock assemblages (i.e. gravitational vs. tectonics), particularly in areas of well-preserved, exhumed subduction–accretion complexes, such as in the Western US Cordillera, Circum-Pacific Region and Circum-Mediterranean Region. In addition, it is well-documented that the mechanisms responsible for the formation of mélanges may occur in a wide range of geological settings, spanning from relatively shallow to deep crustal depths. In this framework, the main discussion revolves around whether the "chaotic disruption" of rock assemblages, observed in exhumed orogenic belts and subduction-accretion complexes, is a result of tectonic shearing and mixing alone, achieved at different depths, or a product of tectonic or diapiric reworking and "recycling" of mass transport deposits (MTDs) during the overall geodynamic evolution of the primary formation setting (see, e.g., Hsü, 1974; Berkland et al., 1972; Silver and Beutner, 1980; Raymond, 1984, 2015; Cowan, 1985; Barber et al., 1986; Bettelli and Panini, 1987; Pini, 1999; Bettelli et al., 2004; Alonso et al., 2006; Festa et al., 2010, 2014, 2016; Vannucchi

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