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Diagnostic features and field-criteria in recognition of tectonic, sedimentary and diapiric mélanges in orogenic belts and exhumed subduction-accretion complexes

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ABSTRACT

Multiple episodes of deformation during the tectonic evolution of orogenic belts and ancient subduction-accretion complexes cause obfuscation of primary block-in-matrix fabric of mélanges, and thereby making the recognition of their tectonic, sedimentary or diapiric origin difficult. Here we present a comprehensive overview and synthesis of a diverse set of field-based stratigraphic and structural criteria, which are at the base of geological mapping rules, to differentiate between various mélange types, developed by disparate geological processes and mechanisms. We first define the current concepts of mélange and mélange nomenclature, and describe the most diagnostic features of tectonic, sedimentary and diapiric mélanges at different scales. We discuss some of the main issues complicating the application of these diagnostic criteria, such as: (i) similarities between the block-in-matrix fabric of different mélange types formed in partially lithified sediments at shallow structural levels, (ii) transformation of fabric elements with increased depth due to tectonic reworking and recrystallization processes, (iii) significance of “exotic” versus “native” blocks in mélange matrix, and (iv) age relationships between blocks and matrix in a mélange. We introduce two additional criteria in approaching these complexities and in recognizing different processes of polygenetic mélanges formation in the field when primary diagnostic fabrics were reworked by multiple deformational events. These new criteria are based on (i) the coherence between lithological compositions of mélange components (blocks and matrix) and characteristics and tectonic evolution of the geodynamic setting of their formation (“tectonic environment criterion”), and (ii) specificity and kinematic coherence in the distribution of deformation between blocks and the matrix (“deformation criterion”). The discussed diagnostic criteria can be applied to all field-based investigations of mélanges and broken formations in orogenic belts and exhumed subduction-accretion complexes around the world, regardless of their location, age, and tectonic history.

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