Mélanges and mélange-forming processes: a geological overview

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Geotechnical engineering projects (e.g., excavations, tunneling, landslide remediation, etc.) in *"bimrocks"* (block-in-matrix rocks) units are commonly strongly complicated by their internal chaotic arrangement, which is characterized by a strong mechanical contrast between blocks and the matrix, and their mutual proportion (e.g., Medley, 2008).

Among several *"bimrocks"* type units, mélanges represent the most common ones, representing significant components of different geological and geodynamic environments worldwide.

This study presents up-to-date observations and interpretations on various mélange types and forming processes from around the world from a geological prospective. The main goals are: (i) to make both the classic and modern concepts in the vast mélange geological literature accessible to those geoscientists and engineers, who are not intimately familiar with the complications in studying chaotic rock units or mélanges, and (ii) to show that different mélange types have different internal block-in-matrix arrangement with significant implications of their mechanical behavior. After the definition of the term mélange, we show that different types of processes (i.e., tectonic, sedimentary, and diapiric) and their mutual interplay and superposition, contribute in forming different mélanges types. A comparative analysis of exhumed, ancient on-land mélanges and modern tectonic environments, allows then to document that close relationships exist between mélange types, their related fabric, and the geological-geodynamic environment of their formation (Festa et al., 2010, 2016). In fact, different mélanges types are close related with extensional tectonics, passive margin evolution, strike slip tectonics, subduction zones, collisional tectonics, and intra-continental deformational settings. We document that these different mélange types are characterized, and can be distinguished each other, by different diagnostic internal fabric and block-in-matrix arrangements (Festa et al., 2019). We therefore discuss the main complication in distinguishing the different diagnostic fabric of mélanges when reworked and overprinted by tectonic processes, as commonly occurred in the geological record.

Detailed studies and observations of mélanges, the different "block-in-matrix" fabric and the related-processes of formation are significant in better understanding and distinguish different types of *"bimrocks"* encountered in geotechnical engineering projects. Therefore, a close collaboration between geologists with expertise in mélanges and engineers is thus fundamental to improve our knowledge and understanding on *"bimrocks"*, reducing the problem of their mechanical characterization, and consequently providing accurate constraints for practical geotechnical characterizations and procedures around the world.

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