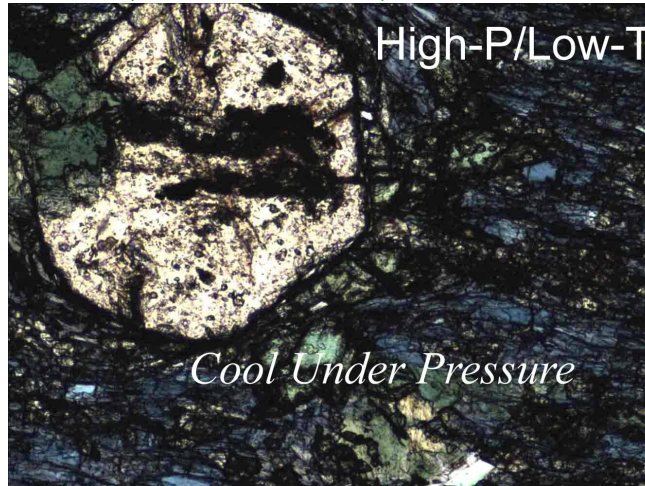


The 2013 State of the Franciscan Address

Complicated gets worse: The thick gray line between mélanges and coherent units and implications for subduction processes and engineering.

John Wakabayashi, Dept. EES, Cal. State Univ. Fresno
Friday March 8, Science II, Rm 125 1:30-3:00 pm



Many believe that the block-in-matrix character of mélanges resulted from megadisplacement along the subduction megathrust or subduction channel. However, detailed field and petrographic studies indicate that the block-in-matrix fabric of the most profound Franciscan mélanges formed as a result of submarine landslides prior to partial subduction and the overprinting of the units by tectonic strain. Fault rocks that resulted from megathrust displacement appear to be localized on the upper contact of the major mélange zones. The architecture of the subduction complex thus consists of nappes composed of both block-in-matrix and coherent units, separated by narrow paleomegathrust zones along the upper contacts of mélanges. Only blocks of higher metamorphic grade than the matrix are obviously exotic in all cases, given recent recognition of "cogenetic" ocean floor stratigraphy. Genuine "tectonic" mélanges form along imbricates of so-called coherent (units without blocks) units, but do not include exotic blocks. The blocks in many mélanges record at least two cycles of burial and exposure, with numerous examples of burial to blueschist facies depths or greater (say 30 km plus) on each cycle. This shows that tectonic-sedimentary recycling along the convergent plate margin was far more widespread than previously believed. Whereas it is widely believed that shale is the dominant matrix type, sandstone matrix (including serpentinite sandstone) may be more common than finer matrix types. The occurrence of sandstone matrix makes recognition of mélanges and the distinction between mélange and coherent units much more difficult from a geologic mapping and an engineering standpoint. The interbedding of sandstone and breccia and a complete gradation between sandstone and breccia further complicates matters. The strength contrast between block and matrix can vary dramatically, and in some cases matrix forms craggy outcrops that mimic the geomorphology of hard blocks in matrix. In other cases, unstrained breccia becomes blocks surrounded by highly strained breccia. The most feared component of subduction complex geology now appears more complicated than ever, and this emphasizes the value of geologic field skills to meet this challenge.