Watch Out! DIFFERENT ROOM

UC **SANTA BARBARA**

Department of Earth Science

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Speakers Club

BROIDA 1640 • THURSDAY OCT 25th.• 2:00 PM

Pyroxenites as windows into the deep lithosphere to surface magmatism connection: constraints using petrology, volatiles, and microstructures

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Earth's magmatism is characterized by the duality of surface expression as volcanic eruptions and a deeper counterpart within the underlying crust and mantle. However, a major disconnect between records of surface vs. deep magmatism is the observation that rarely do magmas erupt that are primary in composition (in equilibrium with their mantle source); thus, all surface volcanism must be filtered for the effects of crystal fractionation, assimilation, and contamination. That is the "top down" approach. Here, I use the "bottom up" approach involving rocks of the deep lithosphere—particularly pyroxenites and cumulates—to reconcile these two perspectives. Such rocks have the advantage that they are closer to the melting source and therefore have seen less secondary processes compared to magmas. Various techniques are used to examine pyroxenites and cumulates, ranging from conventional petrology and geochemistry to newer methods that seek to couple microstructural data to geochemical indicators. I first zoom out to the global view and show that deep crustal cumulates are indeed the fractionally crystallized solid counterparts of primitive magmas along Earth's two major differentiation series, the tholeiitic and calc-alkaline trends. Thus, deep crustal cumulates are, for the most part, the faithful partners left behind as their partner melts escaped to the surface. Second, I discuss possible ways to use lower crustal cumulates to "see through" to the primary composition of melts from which they crystallized, specifically in arc settings. Third, I go deeper into the mantle lithosphere and present new geochemical and microstructural results on composite peridotite/pyroxenite xenoliths, which represent a continuum of melt interaction in the mantle. These data show that despite having strong lattice preferred orientations (LPOs), such LPOs probably did not form by dislocation creep but instead by magmatic-induced shape preferred orientation, probably during cumulate "plating" along conduit walls in the mantle lithosphere. Collectively, ongoing studies of deep pyroxenites and cumulates show promise in using them as probes into early magmatic processes.