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Describing the chemical character of a magma

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We introduce the concepts of hard-soft acid-base (HSAB) and derive parameters to characterize a magma that consists either of a solid rock, a melt or its exsolved gaseous phase. Those parameters are the electronegativity, hardness, electrophilicity, polarisability and optical basicity. They determine the chemical reactivity of each component individually, or its equivalence in the case of a complex system of elements or oxides. This results from equalization methods or from direct computation through density functional theory (DFT). Those global parameters help in characterizing magma, provide insights into the reactivity of the melt or its fluid phase when in contact with another magma, or when considering the affinity of each component for metals. In particular, the description leads to a better understanding on the mechanisms that control metal segregation and transportation during igneous activity. The trends observed during magma evolution, whether they follow a mafic or a felsic trend are also observed using these parameters and can be interpreted as approaching a greater stability. Nevertheless, the trend for felsic magma occurs at constant electrophilicity toward a silica pole of great hardness. Conversely, mafic magmas evolve at a constant hardness and decreasing electrophilicity