One of the important problems of Turkish soils is low phosphorus availability. Thus crop-based and/or yearly application of the phosphorous fertilizers is commonly practiced to alleviate this problem. This practice leads to changes in the magnitude of P and induce inter-fraction mobility among geochemical fractions of phosphorus depending on the occurrence of various soil components along with differences in pedo-transfer functions. In this experiment profile based soil samples were taken from 16 soil series, locating at Denizli, Afyon, Burdur and Antalya cities of Turkey, belong to 4 Ordos formed under different climatical conditions (Mediterranean to continental climate) and parent materials. Physico-chemical properties and the amounts of labile-P fractions in soils were determined. The distribution of the labile-P fractions were subjected to ANOVA and the difference between the labil-P fractions was compared with the Duncan multiple comparison test. The relationships between geochemical fractions and soil physical and chemical properties were revealed by means of conventional correlation and chemometric analysis. The results showed that, the partition of phosphorus in different fractions were likely to be related to parent material, soil genesis and classification, current management systems and physico-chemical properties of soils at any horizon. The amount of available phosphorus fractions varied according to the soil series along the profile. Generally, organic matter increased the phosphorus availability whereas carbonates, amorphous iron oxides, clay content, and pH reduced the available portion of phosphorus in soils.