

MINERALOGICALLY, MORPHOLOGICALLY AND CHEMICALLY INVESTIGATION AND CHARACTERIZATION OF THE CLAY MINERALS SOCIETY SPECIAL CLAYS AND THEIR IMPURITIES USING XRD, SEM/EDS AND XRF TECHNIQUES

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In this study, 12 “special clays” from The Clay Minerals Society were determined and characterized mineralogically, morphologically and chemically using powder XRD, SEM/EDS and XRF techniques. Studied “special clays” include ripidolite, rectorite, montmorillonites, illite, nontronites, illite-smectite mixed layer, sepiolite, beidellite and cookeite. For powder XRD, samples were prepared for both bulk mineralogy and clay fractions. For XRD clay fraction analyses, oriented samples were prepared via the “home method”. Analytical conditions for XRD were the following; generator: Rigaku D/Max-2200 Ultima+/PC, tube: Cu K α =1.54059 Å, filter: Ni, accelerating voltage: 40kV, current: 20mA, goniometer speed: 0.120°/min (overnight), and range: 2-60° 2 theta. The XRD instrument were calibrated using standard silicon powder (NIST SRM 640-c) before its use, and minerals identified using ICDD-PDF2 database. In addition, no-background sample holder was used to reduce the background, and longer counting times (up to 8 hours) and very small step size were applied to obtain high intensities.

Morphological investigation of the clay samples were made using Jeol JSM-6490LV SEM. Before using in the SEM, samples were prepared (dried 2 hours at 60 C) and coated with gold using Polaron E5100 Seri-II. For EDS, SQ and ZAF programs (Z=atomic number, A=absorbtion, and F=fluorescence corrections) were applied.

The chemical combination of the samples analyzed in this study were analysed using all three of the Xepos spectrometer (EDP-XRF), Thermo Niton handle XRF (XL3t 950 DM Goldd+) spectrometer and IXRF-EDS2004 techniques. The XRF instruments were calibrated using standard “inorganics in marine sediment” (NIST SRM 2702) before its use. Acquired major oxides and trace elements were evaluated and compared, so that the opportunity to compare all three chemical analyses techniques with each other was found.

As known, “special clays” are natural materials and they contain some impurities besides clay minerals. Investigated special clays in this study contain minor to significant amounts of other mineral impurities. In this study, special clays and their impurities which were determined as mainly quartz, sanidine, anorthite, anatase, tridymite and lizardite were characterized as mineralogically, morphologically and chemically. Mineralogical, morphological and chemical analyses results were consistent for each phase characterized.

The laboratories at the Turkish Petroleum Corporation (TPAO) now have adequate equipment and trained personnel that can handle the semi-quantitative analyses of minerals and act as a referee laboratory in Turkey.