IMPROVED CONSTRAINTS ON SEDIMENTARY ENVIRONMENTS OF PALYGORSKITE DEPOSITS OF THE HAWTHORNE FORMATION, SOUTHERN GEORGIA, FROM A DETAILED STUDY OF A CORE

MARK P. S. KREKELER*

Department of Earth and Environmental Sciences, University of Illinois at Chicago, Chicago, Illinois 60607, USA

Abstract—The sedimentology and mineralogy of a 2.5 m core from a palygorskite deposit of the Miocene Hawthorne Formation, southern Georgia is described. The lithology involves laminated clay-rich sediment composed of ~90% clay and 10% sand, with six clay-pebble layers present. Sand to pebble-size clasts of phosphate material are common throughout the core. The sand laminations are probably flood-related and the clay-pebble layers are storm deposits, with the pebbles being derived locally from subaerial environments. Phosphate clasts are reworked bone material.

The sands are quartz-rich and are subarkosic in composition with average quartz contents of 86.50% and average total feldspar contents of 11.50%. Heavy minerals observed include orthopyroxene, clinopyroxene, amphibole, zircon, rutile, garnet, tourmaline, kyanite, muscovite, biotite, spinels and opaques. Palygorskite fibers dominate the clay-size fraction of the samples and comprise ~80–90% of sample material with smectite comprising the remainder. Hydroxylapatite comprises ~3% of sediment volume and occurs as individual euhedral hexagonal crystals and as clusters of crystals.

Investigation of this core suggests that the palygorskite deposit represents a dynamic system with regular flooding and storm deposition being common. Mineral composition of sands may be useful for stratigraphic correlation of palygorskite deposits in the Apalachicola Embayment. This study supports the general environmental interpretations of previous workers for the palygorskite deposits of southern Georgia, but provides greater detail.

Key Words—Clay-pebble Layers, Georgia, Hawthorne Formation, Palygorskite, Sedimentary Environment.

INTRODUCTION

Sedimentary palygorskite deposits are extensive systems that are uncommon in the sedimentary record and usually occur in Tertiary rocks. There are essentially three major occurrences of sedimentary palygorskite clays associated with near marine environments. These are: (1) deposits in the Yucatan Peninsula near the village of Saculam and surrounding areas; (2) extensive deposits in Russia south of Kiev; and (3) palygorskite units in the Hawthorne Formation of the southeastern United States. The bulk mineralogy and stratigraphy of these deposits have been studied extensively (Merkel, 1989; Jones and Galán, 1988; Ishphording, 1984; Ovcharenko and Kukovsky, 1984; Weaver, 1984; Weaver and Beck, 1977; Patterson, 1974; Weaver and Beck, 1972; Arnold, 1971; Van Olphen, 1966; Gremillion, 1965; Vaughan, 1902).

Palygorskite units in the Hawthorne Formation are unusual sedimentary systems in the siliciclastic-dominated Tertiary rocks of the Gulf Coast region of the United States and are important industrial mineral deposits. No coastal palygorskite deposits are found in the United States west of the state of Georgia, and these deposits are restricted to the southeast portion of the United States to northern Florida. Why palygorskite deposits are not more common in the Gulf Coast region or at other times in the Tertiary is not understood and there are no modern environmental analogs for comparison.

Palygorskite clays of the Miocene Hawthorne Formation in the Apalachicola Embayment have been the focus of industrial exploration, production and study since 1895 (Galán, 1996; Jones and Galán, 1988; Patterson, 1974). The processes involved in the formation of palygorskite units of the Hawthorne Formation were described as 'perimarine', representing lagoons or small, restricted basins within the Apalachicola Embayment (Patterson, 1974; Weaver and Beck, 1977; Weaver, 1984; Merkl, 1989). Such a depositional environment requires the composition of the water column to vary from saline to nearly freshwater, in a shallow, low-energy setting. For the Apalachicola Embayment, generally higher salinities are believed to occur in the southwestern region and near-freshwater conditions probably occurred in the northeastern regions (Merkel, 1989; Andrews and Abbot, 1985). The latitude of southern Georgia has not shifted more than ~5° north or south since the Miocene (Scotese, 2001). This paleogeographic position indicates that the Apalachicola Embayment was a subtropical to tropical environment.

* E-mail address of corresponding author: rhodochrosite@email.msn.com
DOI: 10.1346/CCMN.2004.0520301

Copyright © 2004, The Clay Minerals Society