COMMON GEOCHEMICAL AND MINERALOGICAL CHARACTERISTICS AMONG ANTIBACTERIAL CLAY DEPOSITS

SANDRA LONDOÑO*, LYNDA WILLIAMS

ASU, Tempe, 85287-1404, USA/Arizona
sandra.londono@asu.edu

Clays have been known for their medicinal properties since prehistory, and now they are used in pharmaceutical and cosmetic preparations due to their sorption capacity and rheological properties. Less understood is their effectiveness as bactericides, in part due to the fact that not all healing clays are antibacterial and in part due to their great mineral and chemical diversity. Williams et al. 2008 conducted a pilot study on two French clays to determine a scientific basis for the antibacterial effect observed against Mycobacterium ulceran. One of the clays was a broad-spectrum antimicrobial, even against antibiotic resistant bacteria. However the other clay enhanced bacterial growth. Antibacterial testing against a Gram-negative (*E. coli*) and a Gram-negative (*B. subtilis*) allowed identification of four more antibacterial clays from different parts of the world. In this work we used methods from clinical microbiology, geology and geochemistry to a compare the antibacterial action of these clays. First we assessed and compared the depositional environments, mineralogy, , and key physical (surface properties) and geochemical variables of the antibacterial clays to non-antibacterial clays to identify variables that could be involved in the bactericide. We manipulated the chemical composition of the samples to determine any change in antibacterial effectiveness. Results suggest that illite/smectite rich samples with reduced Fe phases are common to the antibacterial clays. Recently we discovered a clay that showed inhibition of cell viability on *E. coli* but not in *B. subtilis*. Because these organisms differ in their cell-wall structure, the different response to the clay helps us elucidate a particular mechanism. We believe that the antibacterial activity is controlled by the extremely large surface area of the minerals, surface charge and available metal species toxic to bacteria. Understanding what makes a clay antibacterial could be useful for exploration of these medicinal-mineral resources, and finding new sources of natural drugs to treat infectious diseases.

[1] Williams, L.B., Haydel, S.E., Giese, R.F. and Eberl, D.D., 2008. Chemical and mineralogical characteristics of French green clays used for healing. Clays and Clay Minerals 56 (4): 437-452

Keywords: clay minerals, antibacterial