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Expansive Soils—A Little-appreciated Problem in Environmental Geology

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Approximately 25% of the USA is underlain by expansive soils of some type. Most expansive soils, commonly known as shrink-swell soils, contain significant amounts of smectite or bentonite clays. Soils that contain large amounts of salts or organic matter may also exhibit shrink-swell characteristics. It has been estimated that, on average, expansive soils cause more damage in the United States than earthquakes, tornadoes, hurricanes, and floods combined with an associated cost that is estimated at 7 to 10 billion dollars annually.

According to some investigators, the most notable area of expansive soil in the USA occurs in Texas where approximately 20% of the Texas Coastal Plain is affected by shrink-swell soils. Houston is located in large part on the Beaumont Formation which is composed of late Pleistocene sediments. The vertisol soils that have formed from the overbank and flood basin sediments deposited by fluvial-deltaic systems exhibit highly expansive characteristics. These highly expansive native soils, along with the strong seasonal variations in pre-

cipitation characteristic of the Houston area, have combined to make construction and maintenance of roadways and buildings in Houston an expensive enterprise. Construction and maintenance problems are inherent in structures built on expansive soils caused by the swelling of the soils upon hydration. Some Texas soils exhibit expansion pressures of 150,000 kg/sq m. One local foundation repair contractor reported that in an average year his company makes 600 repairs. Pavement repairs, including buckled freeways and streets, broken curbs and uneven pavement, are the other major source of cost associated with local expansive soils. It is easy to see how estimates of the average annual losses caused by these soils run as high as 100 million dollars.

Expansive soils are a serious but not well understood environmental problem. Much of the work on these soils has been carried out by soil scientists seeking to understand the problems that arise when vertisols are placed under cultivation, or by civil engineers charged with designing buildings and

roadways to withstand pressures exerted by expansive soils. Clearly, in terms of environmental concerns, soils are in the realm of environmental geology. Yet, seldom is a basic environmental soils course offered to students seeking to better understand the interaction of humans and the geologic environment. It may be time for that to change. ■

Dr. Theron D. Garcia is an associate professor teaching geology courses within both the Physical Sciences and Environmental Sciences Programs at the University of Houston Clear Lake. She has introduced courses into the geology curriculum that deal directly with the environmental aspects of soils, such as: Soils in the Environment, Wetlands and Hazards in the Geologic Environment. Dr. Garcia has received the Chancellor's Distinguished Teaching Award and the Amoco Award for Outstanding Teaching. Currently, she and her graduate students are investigating the sediments of Trinity Bay to determine their clay mineralogy through a grant funded by the Environmental Institute of Houston.