

Case 4
Geology, Planning, and Geologic Hazards of Coastal Cities
in Asia and the Pacific

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Impact of geology on the development
of coastal cities
in Asia and the Pacific

Introduction

Some parts of Asia and the Pacific are located in areas frequently affected by damaging geological disasters. A geological disaster or catastrophe is the occurrence of a severe hazardous event. A geologic hazard is defined as a geological condition, process, or potential event that poses a threat to the health, safety, or welfare of a group of citizens or to the functioning or economy of a community or larger governmental entity. The part of Asia extending from the Himalayas through the Pacific rim is particularly vulnerable to earthquakes and volcanic eruptions because of the constant movement and collision in the region of lithospheric plates just beneath the surface of the earth. The circum-Pacific "ring of fire" has been the source of more than 50 percent of the earth's eruptions. The volcanoes in this belt tend to erupt explosively and cause more fatalities and property damage than volcanoes in the interior of continents. There seems to be a relationship between the length of preceding inactivity and the volume and violence of the ensuing eruption: the less frequent the eruption, the greater the violence. Most of the region's active the potentially active volcanoes are in densely populated areas where few people living near them are protected by any form of early warning system or contingency plan. The endangered residents may be unaware that a risk exists. Recent work has shown that eruption forecasting can save many lives, since, fortunately, volcanoes in these areas have been shown to behave in a predictable manner. Many potentially dangerous and known violent volcanoes have histories of

providing warning signals shortly before they erupt. Volcano specialists can interpret these signals. Volcanic hazard and seismo-tectonic maps have been shown to be useful in the region, although more work needs to be done in this area.

The coastal cities of Asia also have many physical characteristics in common and share the problems of low-lying terrain, such as flooding, extensive and poorly drained back-swamp areas, and soft clay soils. Moreover, many of these cities have overexploited their groundwater reservoirs and have introduced sea water into aquifers which once supplied fresh water to city wells. Since groundwater levels have been severely lowered, many of these cities have suffered regional lowering of the land surface or subsidence¹ in response to dewatering and compression of the underlying soft sediments. Cities of Asia continue to experience explosive growth and have out-paced any plans that were originally made for them to supply water, provide drainage, and treat sewage.

Many coastal areas of the region consist of unconsolidated sands and clays, which contain no economic mineral deposits. Geologists have tended to ignore these areas of surficial sediment in favor of the study of hard rocks containing economic mineral deposits. Only in areas of rich alluvial and beach tin placers have detailed studies of these sediments been undertaken, and these few studies are limited in their application to the needs of coastal cities.

Although nearshore and offshore waters have been the focus of intensive studies for decades, coastal plains² and deltaic regions have not been mapped in detail. Geology may be only one part of the complex coastal ecosystem, but it affects urban development more than any other single factor. Yet geology is