the occurrence of springs and character of volcanic rock.

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GEOLOGIC CONTROLS OF MINERAL DEPOSITS IN TAIWAN

Geologic controls of mineral deposits can be classified into stratigraphic, magmatic, and structural and each control may be divided into several kinds. Generally the three controls are so closely related to one another in time and space that most of mineral deposits are usually associated with two or three of them.

The economically workable mineral deposits of Taiwan include bedded cupriferous iron sulfide deposits, gold-silver-copper deposits, carbonate deposits, sulfur deposits, and geotherms. The bedded cupriferous iron sulfide deposits were related to stratigraphic (primary-geosynclinal to basinal), magmatic (volcanic-basic), and structural (secondary-macroscopic to microscopic) controls; the gold-silver-copper deposits to stratigraphic (secondary-local), magmatic (volcanic-intermediate), and structural (primary-mesoscopic) controls; the carbonate deposits to stratigraphic (primary-geosynclinal to basinal) and structural (secondary-macroscopic to microscopic) controls; the sulfur deposits and geotherms to magmatic (volcanic-intermediate) and structural (primary-mesoscopic) controls.

The geologic controls of mineral deposits which have been studied in Taiwan may be applicable for locating and prospecting for mineral deposits in other regions of the northwestern Pacific island arcs where geologic features are similar.

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IMPACT OF ECONOMIC DEVELOPMENT ON DEMANDS FOR GROUNDWATER AND WASTE DISPOSAL IN HONOLULU

Hawaii long has been acclaimed as the paradise of the Pacific, but only after discovery by Captain James Cooke in 1778 was her beauty exposed to the outside world. At first a place for replenishing provisions and water for whaling ships, Honolulu has experienced a rapid economic growth which has made her the center of trade in the Pacific region. Her rise to prominence has not been free of problems. Like many large cities, Honolulu, the capitol of the state, is suffering from the strains imposed by an ever increasing population. The relentless demand for an adequate supply of water and an environmentally acceptable sewage disposal system are just two of the many crises facing Honolulu today.

Honolulu—city and county—encompasses the whole island of Oahu and contains about 82% of the state's population. This concentration imposes a heavy burden on the available groundwater supply. The developable water supply has been estimated to be about 525 mgd. With a present groundwater draft of 440 mgd, only 85 mgd is available for future use making alternative sources imperative. Desalting and wastewater recycling and impoundment of surface waters for trade-off with agriculture are possible alternatives.

Waste-disposal systems play a critical role in protecting groundwater supplies. Although sewage systems have not kept pace with the city's development, preventing the widespread indiscriminate disposal of sewage by cesspools, septic tanks, and other similar facilities has not been an easy task. Rules and regulations by governmental agencies have been implemented to control waste-disposal facilities and protect the groundwater supplies. The uncertainty associated with viral detection and destruction is one of the major reasons for the conservative measures applied to waste-disposal facilities.

Despite the problems, we are confident that through research, cooperative effort, constant vigilance, and sound long-range planning, we will overcome the problems brought about by economic developments.

ZARELLA, W. M.

ENVIRONMENTAL CONSTRAINTS OF EXPLORATION, PRODUCTION, AND TRANSPORTATION IN CIRCUM-PACIFIC AREA

No abstract available.

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HYDROCARBON POTENTIAL OF AMAZON BASINS OF COLOMBIA, ECUADOR, AND PERU

The Oriente, Ucayali, and Madre de Dios basins in the Amazon drainage of Colombia, Ecuador, and Peru are members of a series of large asymmetric depressions between the Andean cordillera and the Guiana and Brazilian shields. They are separated from one another by basement arches and have areas of 458,000, of 200,000, and of 95,000 sq km, respectively. The area is topographically low, covered by heavy rain forest, traversed by many huge tributaries of the Amazon and is sparsely populated.

From early Paleozoic time until the Maestrichtian, seas repeatedly invaded the area, depositing a variety of sediments, but mostly calcareous and silicate clastic deposits. At the beginning of the Tertiary, dominantly marine deposition gave way to nonmarine deposition, reflecting the Andean orogeny and topographic development of the Andes Mountains. The depositional cycle of major importance for hydrocarbons took place in the Cretaceous. A complete marine cycle of miogeosynclinal sedimentation is represented with a maximum thickness of 2,500 m, but it thins and becomes sandier toward the east. Although the cycle consists mainly of sands and shales, limestones and sandy limestones are important potential reservoirs. Most prospective structures in the basin are anticlines, generally fault-bounded and steeper on the east. Salt domes and other diapiric structures are also present. Amplitude of structures and intensity of deformation decrease eastward. The formation of structures and the migration and entrapment of hydrocarbons appear to have occurred at various times in the Tertiary.

The state of exploration in the Colombian part of the Oriente basin is well advanced with low-undiscovered potential. In Ecuador, although the peak of exploration activity has been passed, the future potential may be substantial. In Peru exploration drilling in the Oriente basin already has discovered reserves on the order of 400 million bbl of oil. On the basis of these facts and on information from Colombia and Ecuador, the total potential of the Oriente basin is estimated to be 25 to 35 billion bbl.

About 20 wildcats have been drilled in the Ucayali basin with the discovery of two small oil