



Note: The distribution of saline minerals is drawn from generalized compilations, the accuracy of which is limited by the availability of information as well as the small scale of the map, and may be incorrectly shown in many areas. The manganese-oxide deposits are shown only at stations where they have been sampled or photographed. They may extend over large areas, but available information is not sufficient to infer either their continuity between stations where reported or their absence in areas where they have not yet been found. The offshore phosphorite deposits are shown in the general areas in which they have been reported or which are favorable for their occurrence, rather than at individual stations where sampled, and their distribution may be more or less extensive than shown. No commercial value should be attributed to any mineral deposits or areas on the basis of their occurrences shown here.

Onshore Offshore

Bees of anhydrite (ruled), in many areas with beds (ruled) and domes or plugs (small circles) of salt within sedimentary basins of marine origin. Locally favorable for potash and magnesium deposits associated with salt, and for sulfur (fracture type) deposits associated with anhydrite in beds and salt-dome cap rock. Evaporite basins of marine origin are broadly favorable for accumulation of petroleum, and salt domes provide favorable structures for its entrapment.

Coastal Offshore

Known potash deposit

Known sulfur deposit

Fracture type only. Sour natural gas (hydrogen sulfide rich) and asphalt base crude oil may be an important offshore source of sulfur in some areas.

Phosphorite

Offshore areas in which deposits are known or which are favorable for their occurrence

Guano or phosphatized rock

Coastal and insular occurrences that suggest the presence in some areas of similar subsea deposits submerged as a result of sea-level changes or tectonic movements

Manganese-oxide pavements, crusts, or nodules on the sea floor

Location of nodules recovered by sampling shown by circle with cross; photograph showing more than 25 percent of bottom covered by nodules indicated by plain circle; photograph showing 25 percent or less of bottom covered by nodules indicated by half circle; photograph showing no nodules indicated by dot

Area where offshore exploration is in progress

Principal mineral indicated by letter—P, phosphorite; Cu, copper; Zn, zinc

Metal-bearing mud

Reported thus far only from the Red Sea, a submarine volcano off Indonesia, and in sea concentrated deposits, on the crest of the East Pacific Rise. Possibly present also in other rift or fracture zones, in parts of the deep trenches, in volcanic craters, or in other environments in which rising hydrothermal solutions may have been trapped

200-meter isobaths

Approximates in many places the edge of the continental shelf

2500-meter isobaths

Approximates in many places the toe of the continental slope

#### EXPLANATION

VAN DER GRINTEN PROJECTION

SCALE 1:28,283,200 AT THE EQUATOR

(SCALE ELONGATION CHANGES WITH BOTH LATITUDE AND LONGITUDE)

500 0 500 1000 1500 2000 2500 3000 NAUTICAL MILES

500 0 500 1000 1500 2000 2500 3000 STATUTE MILES

500 0 500 1000 1500 2000 2500 3000 KILOMETERS

### Preliminary Map Saline minerals, sulfur, phosphorite, manganese-oxide nodules, and metal-bearing mud WORLD SUBSEA MINERAL RESOURCES

Compiled by  
V. E. McKelvey, Frank F. H. Wang, and Tau Rho Alpha  
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Source: Location of saline deposits drawn mainly from Meyerhoff, 1970; Kozary, Dunlap, and Humphrey, 1968; Lefand, 1968; Pendery, 1969; Rios, 1968; Liechi, 1968; Tortochaux, 1968; Stocklin, 1968; McNaughton and others, 1968; Henov and Lewitz, 1960; Benavides, 1968; Gornall and Adelman, 1968; Menard, Smith, and Pratt, 1965; Murray, 1968; Gould and de Mille, 1968; Senneman, 1968; Meyerhoff and Hatten, 1968; Kent, 1965; Beltracchi, Hertz, and Wenger, 1965; Ayala, 1965; Denison, 1965; Gill, 1965; Pearson, 1963; Withington, 1962; Douglas and others, 1963; Burk and others, 1963; and personal communications from C. L. Jones, Robert J. Hite, and Ray G. Martin, Jr., of the U.S. Geological Survey, and A. A. Meyerhoff, American Association of Petroleum Geologists. Distribution of manganese-oxide deposits from unpublished compilations kindly furnished by Gustaf Arrhenius of the Scripps Institution of Oceanography and Maurice Exing of the Lamont-Doherty Geological Observatory, and Meno, 1965; Menard, 1964; Cronan, 1967; Strakov and others, 1968; Manheim, 1965; Meylan, 1968. Distribution of metal-bearing mud from Miller and others, 1966; Eostrom and Peterson, 1966; and Zelenov, 1964. Location of deposits of guano and phosphatized rock mainly from Hutchinson, 1950; subsea deposits of phosphorite from McKelvey, 1963.

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