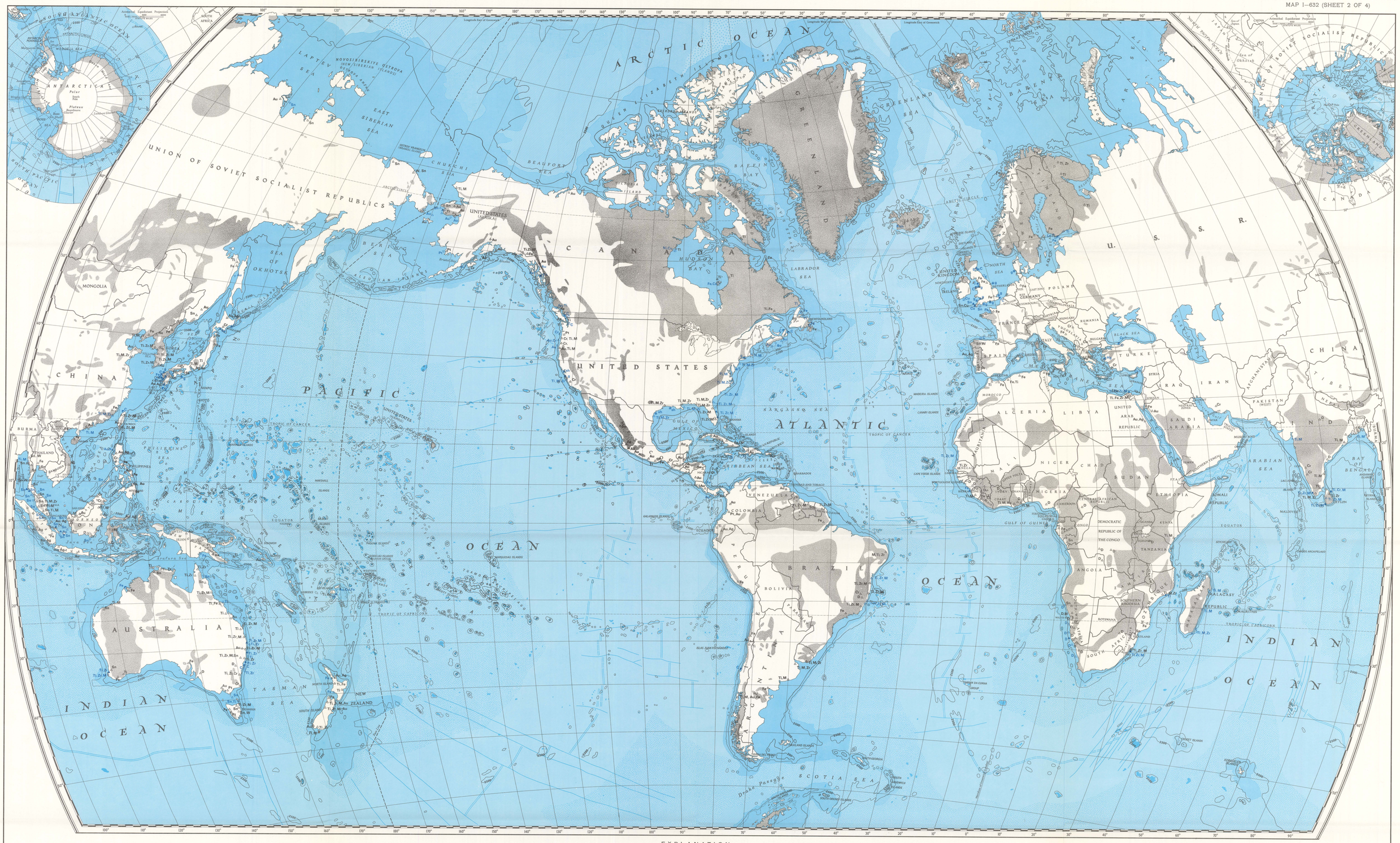

EXPLANATION

CONTINENTAL GEOLOGIC FEATURES

Sedimentary rocks

Includes lava flows and pyroclastics overlying or interbedded with sedimentary rocks. Locally favorable for minerals commonly associated with sedimentary rocks, such as petroleum (including oil or gas), tar sands, oil shale, coal, limestone, quartz sand, clay, phosphorite, saline minerals, and heavy-mineral concentrates. Also, locally favorable for minerals commonly associated with crystalline rocks (see below) in areas where sedimentary rocks are thin or are cut by igneous rocks

Crystalline rocks

Igneous and metamorphic rocks. Excludes lava flows and pyroclastics overlying or interbedded with sedimentary rocks. Locally favorable for metalliferous deposits in bedrock, heavy-mineral concentrates (placers) in stream sediments and, in areas of deep weathering, residual metalliferous deposits such as iron-, aluminum-, or nickel-rich laterite

OCEANIC PHYSIOGRAPHIC AND GEOLOGIC FEATURES

Continental shelf and slope

Includes continental borderland where well-defined shelf is not present. Represents submerged part of the continent, mainly composed of continental crust (largely granitic but in part basaltic in composition). Bedrock consists of crystalline rocks overlain in most areas by sedimentary rocks. Crystalline rocks and the mineral deposits possibly associated with them may occur at or near the surface of the shelf adjacent to areas where they crop out on land. Sedimentary rocks and the minerals locally associated with them (including petroleum) occur on the outer parts of most shelves as well as on the inner parts adjacent to areas where they occur on land. Surficial sediments overlying either crystalline or sedimentary rocks may locally contain phosphorite or manganese-oxide nodules, heavy-mineral concentrates (placers), sand, gravel, shell, and lime-mud deposits

Continental rise or floor of small ocean basin partially filled with sediments

Continental and (or) oceanic (basaltic) crust overlain by thick accumulation of sedimentary debris largely derived from adjacent continents. Locally favorable for petroleum where thickness of sediment is more than 1000 meters; possibly favorable for sulfur and potash in areas underlain by saline deposits. Generally not favorable for other minerals

Trench and adjacent swells

Bedrock is mainly basalt and related rocks, in places overlain by variable thicknesses of sediment, some of which may be consolidated. Conceivably favorable locally for metalliferous deposits. Generally unfavorable for petroleum

Abyssal plains and hills

Oceanic crust. Bedrock is basalt and related rocks, generally overlain by thin veneer of unconsolidated sediment. Manganese-oxide nodules and pavements may be present over large areas. Unfavorable for petroleum, except where thickness of sediment is more than 1000 meters, and for sulfur and potash. Conceivably favorable for metalliferous deposits (e.g., copper, nickel, chromium, cobalt, and platinum) in bedrock, particularly along fracture zones and possibly in surficial sediments

Oceanic rise and ridge

Oceanic crust. Bedrock is basalt and related rock, which is exposed on the sea floor in many areas and covered by a thin veneer of sediment elsewhere. Manganese-oxide nodules may be present locally. Unfavorable for petroleum, sulfur, and potash. Conceivably favorable locally for metalliferous deposits in bedrock, particularly in fracture zones, and possibly in surficial sediments, particularly where a rift zone lies in a small ocean basin, such as the Red Sea or Gulf of California, or contains closed depressions

Volcano, volcanic seamount, or guyot

Boundary defined as base of steep slope. Basaltic in large ocean basins and andesitic in island arcs and adjacent marginal seas. Manganese-oxide nodules may be present in some areas. Unfavorable for petroleum. Basaltic volcanoes generally unfavorable for other metalliferous minerals also, but andesitic ones may be locally favorable for base and precious metals

Composite volcanic ridge, formed by overlapping volcanoes

Boundary defined as base of steep slopes. Bedrock is basalt, generally unfavorable for petroleum and other minerals. Manganese-oxide nodules may be present in some areas

Ridge or plateau of unknown composition

Composed of either continental or oceanic rock types. Manganese-oxide nodules present in some areas. May include local areas favorable for metalliferous deposits in bedrock and other areas favorable for petroleum

Approximate zones of rift valleys along oceanic ridge crests

Major cross-fracture zones

Beach or offshore placer deposit or onshore source deposit of placer minerals

Active beach or offshore placer mine shown in blue solid triangle, offshore placer deposit in blue open triangle, and onshore source deposit in black. Principal mineral shown by letter—Fe, iron; Ti, titanium; Sn, tin; Au, gold; Pt, platinum; M, monazite; D, diamond; Cr, chromite; Zr, zircon; Ag, silver; W, tungsten; Cu, copper; Zn, zinc

Offshore sand, gravel, shell, and lime-mud mining operations

Mineral mined shown by letter—g, sand or gravel; sh, shell; lm, lime mud

Offshore barite mine

Surface mine off southeast Alaska

Area where offshore exploration is in progress

Includes exploration for all minerals except petroleum. Not shown in vicinity of active mines. Principal mineral indicated by letter—Au, gold; Cu, copper; D, diamond; M, monazite; Pt, platinum; Sn, tin; Ti, titanium-bearing minerals; Zr, zircon

C Active — Fe Inactive

Subsea underground mine

Mineral mined shown by letter—C, coal; Fe, iron; Sn, tin; Au, gold; Cu, copper; Hg, mercury

200 — **200-meter isobaths**

Approximates in many places the edge of the continental shelf

2500 — **2500-meter isobaths**

Approximates in many places the toe of the continental slope

Source: Boundaries of seabottom physiographic and geologic provinces and location of fracture and rift zones replotted from manuscript maps kindly furnished by H. W. Menard (see Menard and Smith, 1966). Distribution of crystalline rocks derived from Physical-Geographic Atlas of the World, Moscow, 1964, and other geologic and tectonic maps of individual continents. The 200-meter isobath is the 100-fathom (183 meters) isobath of the National Geographic Society's Map of the World, 1968 edition, supplemented locally by other data; its true position thus lies generally seaward of that shown here by a distance that in most areas is insignificant at the scale of this map. The 2500-meter isobath in North American waters is taken from U.S. Geological Survey, 1969, Tectonic Map of North America; elsewhere is derived from the National Geographic Society map by interpolation between 1000- and 2000-fathom isobaths, guided locally by other data.

Distribution of subsea minerals largely from other compilations, including Mero, 1965; Cruickshank, 1962; United Nations Economic and Social Council, 1969. Unpublished data kindly furnished by M. J. Cruickshank of the U.S. Bureau of Mines on the location of subsea sand, gravel, and shell mining operations and current subsea mineral exploration, and by C. F. Austin of the U.S. Naval Weapons Center on the location of subsea underground mines.

Base after National Geographic Society's Map of the World, 1968, with modifications by the U.S. Geological Survey

Political boundaries are approximate and should not be regarded as having official significance

Second printing, slightly revised

VAN DER GRINTEN PROJECTION
SCALE 1:39,283,200 AT THE EQUATOR
(SCALE ELSEWHERE 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

Geologic and physiographic provinces, subsea underground mines, and coastal placer deposits

WORLD SUBSEA MINERAL RESOURCES

Compiled by
V. E. McKelvey, Frank F. H. Wang, Paula Quinterno, and Sandi Hayden

1970

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Explanatory pamphlet accompanies map