DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

MINERAL RESOURCES OF THE ZWAGG ISLAND WILDERNESS STUDY AREA, CURRY COUNTY, OREGON

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U.S. Geological Survey
Open-File Report 88-257

Prepared by the U.S. Geological Survey and the U.S. Bureau of Mines

for the U.S. Bureau of Land Management

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey.

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1988

STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Area

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine the values, if any, that may be present. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of the Zwagg Island Wilderness Study Area (OR-012-014), Curry County, Oregon.

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SUMMARY

Abstract

The Zwagg Island Wilderness Study Area (OR-012-014) encompasses 5 acres on the southern Oregon coast west of the town of Brookings. Geological, geochemical, and mineral surveys were conducted by the U.S. Geological Survey and the U.S. Bureau of Mines in 1986 to assess the mineral resources (known) and mineral resource potential (undiscovered) of the study area. There is no evidence of mining activity on or near Zwagg Island. There are no identified resources within the study area, and there are no indications of undiscovered mineral or energy resources. There is a low potential for river riprap resources. In this report, references to the "Zwagg Island Wilderness Study Area" or "study area" refer to the land for which mineral surveys were requested by the U.S. Bureau of Land Management.

Character and Setting

The Zwagg Island Wilderness Study Area is on the southern coast of Oregon adjacent to the town of Brookings in Curry County (fig. 1). The 5-acre island is flat topped and surrounded by steep cliffs that rise about 100 ft from sea level. Offshore rocks, many of which are awash during high tide, are scattered around three sides of the island (fig. 2). The north end of Zwagg Island is connected to the shore by a tombolo, or sand barrier, which provides access to the island except during the highest winter tides. A precipitous trail leads from the beach to the top of the

The study area is underlain by Jurassic and Cretaceous (see appendixes for geologic time chart) sandstone, siltstone, conglomerate, and greenstone that is fractured and faulted.

Identified Resources and Mineral Resource Potential

There are no identified resources in the study area. Studies revealed no evidence of undiscovered mineral or energy resources in the study area. Rock similar to that found on Zwagg Island has been used elsewhere in the region for construction materials. Stone from Zwagg Island has a low potential for river riprap, although the U.S. Bureau of Mines has determined that better quality construction rock is more abundant elsewhere and is readily available from nearby sources.

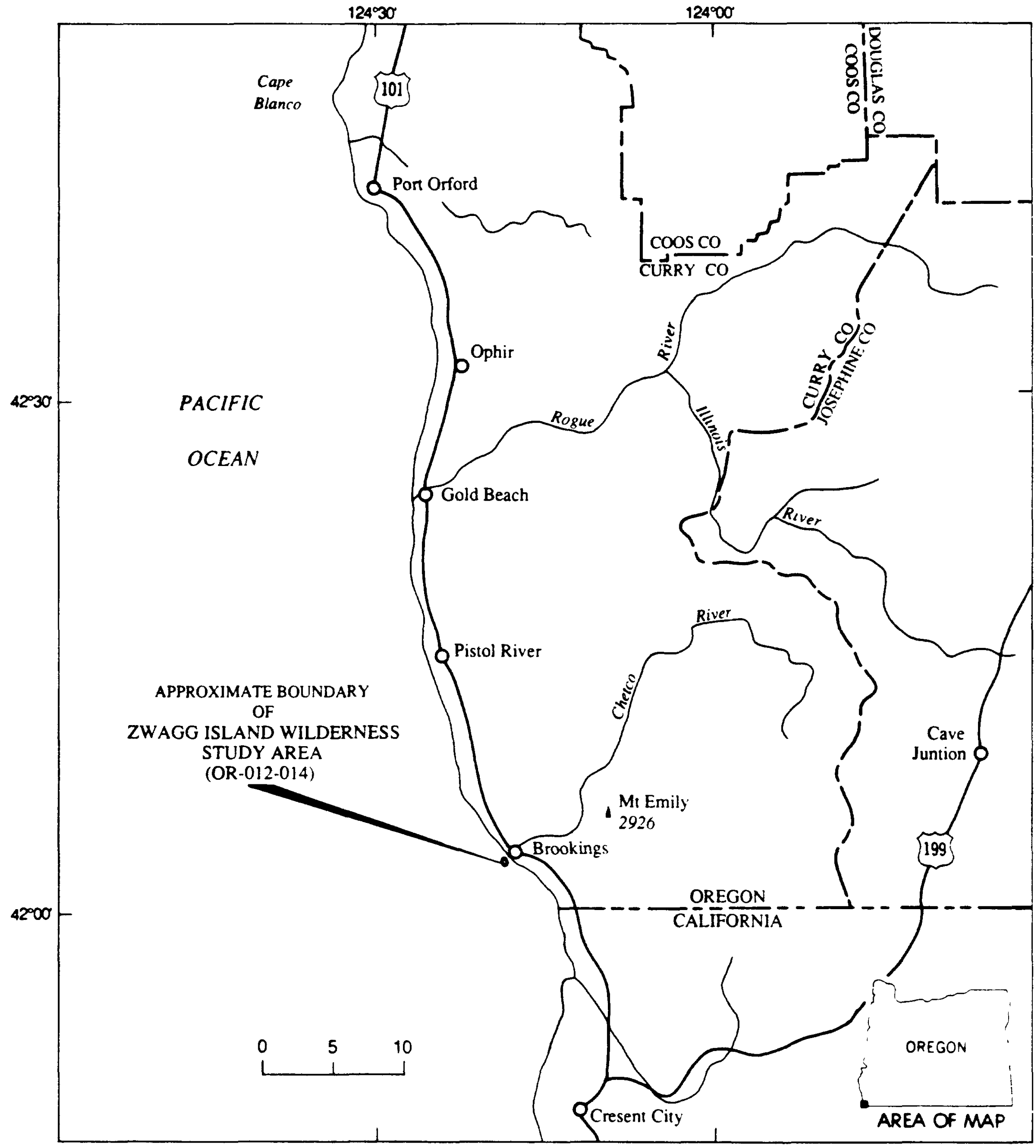
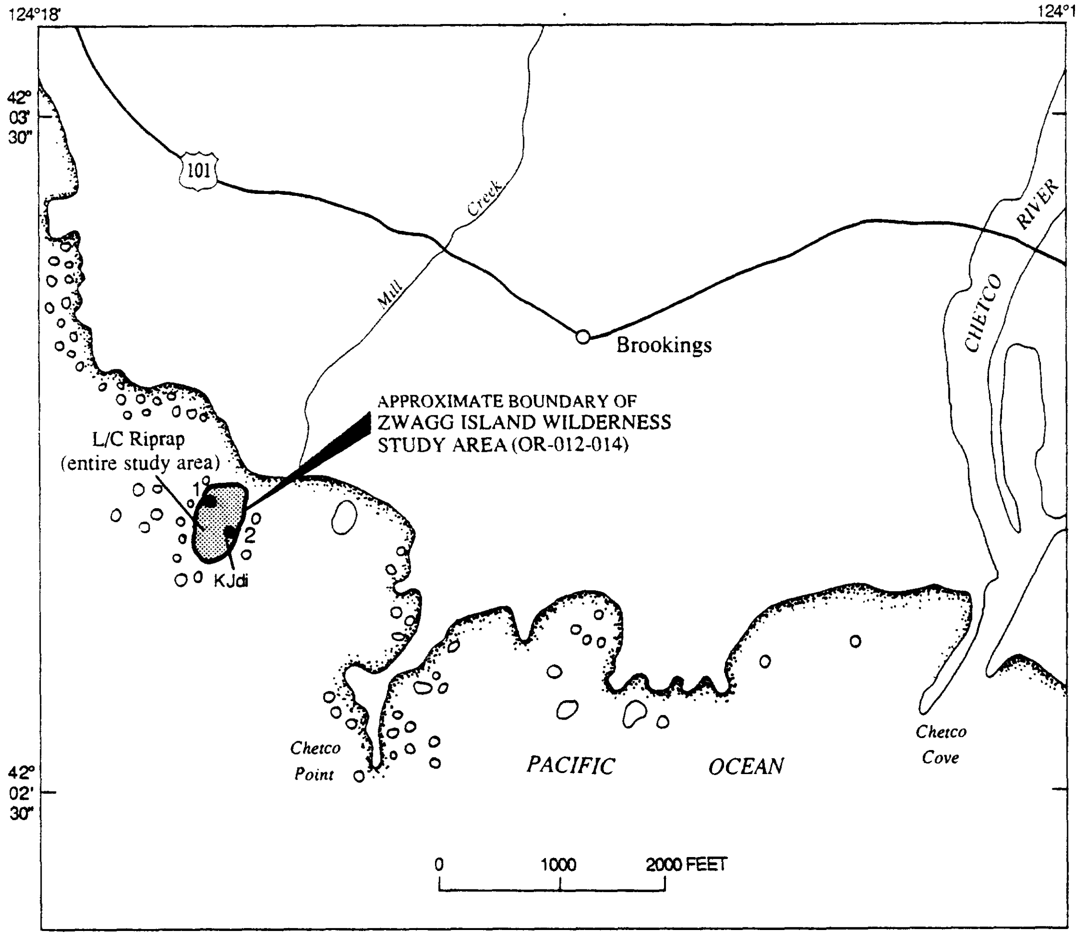


Figure 1. Index map showing location of the Zwagg Island Wilderness Study Area, Curry County, Oregon.



EXPLANATION

Area having low mineral resource potential (L)

C Certainty level of assessment–Data give good indication of level of potential

Description of map units

KJd Dothan Formation (Lower Cretaceous and Upper Jurassic)–Thin- to thick- bedded, poorly sorted, fine- to coarse-grained sandstone with lesser amounts of grit and pebble conglomerate; interbeds of black siltstone as thick as 6 ft; minor amounts of greenstone

—— Contact

● Sample location–See table 1

Figure 2. Generalized geologic map showing areas of mineral resource potential in the Zwagg Island Wilderness Study Area, Curry County, Oregon.

INTRODUCTION

This mineral evaluation was requested by the U.S. Bureau of Land Management and is the result of a cooperative effort by the U.S. Geological Survey and the U.S. Bureau of Mines. The U.S. Bureau of Mines evaluates identified resources at individual mines and known mineralized areas by collecting data on current and past mining activities and through field examination of mines, prospects, claims, and mineralized areas. Identified resources are classified according to the system modified from that described by McKelvey (1972) and U.S. Bureau of Mines and U.S. Geological Survey (1980). Studies by the U.S. Geological Survey are designed to provide a reasonable scientific basis for assessing the potential for undiscovered mineral resources by determining geologic units and structures, possible environments of mineral deposition, presence of geochemical and geophysical anomalies, and applicable ore-deposit models. Mineral assessment methodology and terminology as they apply to these surveys were discussed by Goudarzi (1984). See appendixes for the definition of levels of mineral resource potential and certainty of assessment and for the resource/reserve classification.

Area Description

The Zwagg Island Wilderness Study Area (OR-012-014) is a 5-acre island that is roughly oval-shaped, with steep cliffs on the sides and a relatively flat top. The flat top indicates that the island was formerly part of the marine terrace present at the same elevation onshore. Zwagg Island is surrounded by numerous large rocks, some of which remain exposed at high tides. The top of the island is about 100 ft above sea level and has a thin mantle of soil that supports coastal shrub vegetation including salal, wax myrtle, twinberry, poison oak, and patches of grass (U.S. Bureau of

Previous Investigations

Diller (1914) discussed the mineral resources of southwestern Oregon. Butler and Mitchell (1916) described the geology and mineral resources of Curry County. Dott (1971) described the geology of the southwestern Oregon coast and prepared a geologic map of the area at a scale of 1:250,000. Beaulieu and Hughes (1976) included information on the mineral resources of western Curry County and a geologic map of the region at a scale of 1:62,500. Ramp and others (1977) described the geology, mineral resources, and rock material of Curry County and included a geologic map at a scale of 1:125,000. A draft wilderness environmental impact statement was prepared by the U.S. Bureau of Land Management (1985).

Present Investigations

The U.S. Geological Survey conducted field investigations in 1986 and 1987. Work consisted of checking existing geologic maps and of taking geochemical samples. Geochemical samples were collected and analyzed in order to obtain information about mineral suites and trace-element signatures that can indicate mineralized areas. These samples were analyzed by semiquantitative spectrographic methods.

The U.S. Bureau of Mines compiled literature relating to geology and mineral resources prior to examination of the study area in the summer of 1986. U.S. Bureau of Mines and U.S. Bureau of Land Management records, and Curry County, Ore. records of mining claims were searched for information on mines and prospects located in and around the study area. Heavy minerals in samples of sand from the beach that adjoins the island were concentrated in the field by panning and in the laboratory on a Wilfley1 table. Detailed information can be obtained by contacting the U.S. Bureau of Mines Western Field Operations Center, E. 360 Third Ave.,

Acknowledgments

Edward L. McHugh was ably assisted in the field by Harry W. Campbell, physical scientist, U.S. Bureau of Mines, Western Field Operations Center, Spokane, WA.

APPRAISAL OF IDENTIFIED RESOURCES

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Mining History

Gold was discovered in beach placers along the southern Oregon coast in 1852; by 1871, older marine terraces above the present high-tide line were being mined for gold (Diller, 1914). Gold-, platinum-, and chromite-bearing black sands were known on beaches near the mouth of the Chetco River in the early 1900's (Day and Richards, 1906; Hornor, 1918), but apparently no metals were produced from beach or terrace deposits near Zwagg Island.

The most significant deposits that contained gold and platinum were at Pistol River, Gold Beach, Ophir, Port Orford, and Cape Blanco (fig. 1). Deposits at some locations reportedly had high gold contents and were soon mined out; prosperity was brief because of difficulty in recovering the extremely fine grains of gold and platinum. The deposits were worked and tested intermittently through 1941. Chromite in the sands drew interest during World War II. No deposits on active beaches proved feasible to mine, but 2.0 million tons of sand that averaged 3.8 percent chromium oxide were mined and concentrated from elevated marine terraces in northern Curry County and Coos County (Wetzel, 1985, p. 32). Interest in recovery of metals from the deposits has been sporadically rekindled in recent years (Kulm and others, 1968, 1986; Bowman, 1972).

Construction materials mined near Zwagg Island include sand, gravel, and stone. At least 16 stone quarries within 7 mi of Zwagg Island are listed by Ramp and others (1977). The stone consists mainly of sandstone, conglomerate, greenstone, and basalt of the Dothan Formation and is used for fill, as a base or topping for roads, and for riprap. Ten of the quarries produced less than 50,000 yd^3 (cubic yards), five produced 50,000 to 150,000 yd^3, and one produced more than 150,000 yd3 of material. Nine of the previously quarried sites are classified by Ramp and others (1977) as having potential for moderate to large future production (greater than 50,000 yd^3). At least five of these have been active in the past 10 years.

Jetties were built at the mouth of the Chetco River, 1.2 mi east of Zwagg Island, in 1957. The jetty stone was from a quarry in greenstone on the north bank of the Chetco River 7 mi from the harbor. Reconstruction and extension of the jetties between 1962 and 1969 made use of blueschist from McVay Rock, 3 mi south of the harbor, and rocks from the Chetco River greenstone quarry (P. Grumbaugh, U.S. Army Corps of Engineers, written commun., 1986). A proposal to extend both jetties was presented by the U.S. Army Corps of Engineers in 1975. Extension of the south jetty by 1,250 ft and of the north jetty by 750 ft would require approximately 330,700 tons (202,000 yd3) of jetty stone. A draft environmental impact statement (U.S. Army Corps of Engineers, 1975) cited four possible sources of stone for the project: two along the Chetco River, one north of Brookings, and one south. At least two of these sources would be needed to complete the project. The project was programmed for

Seven sand and gravel sites are along the Chetco River within 4 mi of Zwagg Island. All but one are shown by Ramp and others (1977) as having produced more than 150,000 yd3 of sand and gravel, and all are classified as having potential for large production in the future.

Mining activity at three other locations in the vicinity of Zwagg Island was described by Ramp and others (1977). The nearest is 4.5 mi to the north, where about 580 tons of priceite (hydrous calcium borate) were mined between 1890 and 1892. A zone of manganese-oxide enrichment in banded chert of the Dothan Formation was prospected about 7 mi north of Zwagg Island. Mineralized zones on Mt. Emily, 8 mi to the northeast, apparently contain small amounts of gold, silver, zinc, and molybdenum and traces of arsenic and mercury. No similar deposits or mineralized

Mineral Resources

No mineral resources or evidence of mining activity were found on or adjacent to Zwagg Island. Ramp and others (1977) described marine terrace deposits in Brookings that extend north and south and that possibly contain lenses of black sands. However, no concentrations of black sands were found during this study on Zwagg Island, on the nearby marine terrace, or in the beach sands that separate Zwagg Island from the mainland. The panned concentrate sample of beach sand contained no detectable gold or platinum-group metals and only traces of chromite and magnetite (McHugh, 1986). Gravity and magnetic concentration methods have been used in the past for recovery of metals from known black-sand deposits but are not feasible at current metal prices (Wetzel, U.S. Bureau of

The possibility of using stone from Zwagg Island for construction material was discussed in the Oregon Wilderness Environmental Impact Statement (U.S. Bureau of Land Management, 1985). Sandstone of the Dothan Formation from Curry County, tested by the Oregon State Highway Division (Ramp and others, 1977, table 4) and the U.S. Army Corps of Engineers (P. Grumbaugh, written commun., 1986), showed marginal to good resistance to grinding. Unmetamorphosed sandstone and conglomerate of the Dothan Formation make up most of Zwagg Island. Blocky material of the Dothan Formation is suitable for use as river riprap, but that on Zwagg Island would probably not meet minimum density, uniformity, and physical competency standards for jetty stone (P. Grumbaugh, U.S. Army Corps of Engineers, personal commun., 1986).

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

By Joel R. Bergquist *and* Harley D. King
U.S. Geological Survey

Geology

The bedrock of Zwagg Island comprises sandstone, siltstone, conglomerate, and greenstone of the Upper Jurassic and Lower Cretaceous (Blake and others, 1985) Dothan Formation. The predominant rock type on the island is thin- to thick-bedded, poorly sorted, fine- to coarse-grained sandstone with lesser amounts of grit and pebble conglomerate. Interbeds of black siltstone as thick as 6 ft are found locally in the sandstone. Minor amounts of greenstone (metamorphosed basalt) are also present. The sedimentary rocks and the greenstone occur as large disordered blocks. The complex aggregation of lithic blocks and the exposed fault surfaces are evidence of postdepositional tectonic deformation. The bedrock on the island is jointed, fractured, and faulted; permeability is restricted to joints and bedding and fault planes (Beaulieu and Hughes, 1976).

Along the coast of Curry County, wave action has locally sorted lenses of beach sand that are rich enough in heavy minerals to produce beach placer deposits, which are now found on beaches, marine terraces, and submerged terraces. The placer deposits contain chromite, magnetite, ilmenite, platinum, olivine, garnet, and minor amounts of gold (Beaulieu and Hughes, 1976). There are no placer deposits on or adjacent to Zwagg

Geochemical Studies

The U.S. Geological Survey collected two rock samples and one panned concentrate of surf sediment. The rock samples were analyzed for 31 elements using a six-step semiquantitative emission-spectrographic method described by Grimes and Marranzino (1968). Additional analyses were done by atomic absorption for gold, mercury, arsenic, bismuth, cadmium, antimony, and zinc. No anomalous concentrations of elements were detected in the rock samples, and the geochemical data (table 1) give no indication of mineralization in the study area. The sample of panned concentrate was examined microscopically for gold and platinum, but

Mineral Resource Potential

There are no identified resources in the Zwagg Island Wilderness Study Area, and there are no indications of undiscovered mineral or energy resources. The study area is underlain by sandstone, siltstone, conglomerate, and greenstone of the Dothan Formation. The rock could be used for commercial purposes, but other nearby sources of rock are more accessible, contain more material, and are closer to existing markets. The rock on Zwagg Island could be used as river riprap but is not considered suitable for use as ocean riprap because of its low abrasion resistance (Beaulieu and Hughes, 1976). For these reasons the rock on Zwagg Island is considered to have low potential, certainty level C, for river riprap

There is no geologic evidence and there are no other indications of oil and gas within the study area (Fouch, 1983). Based on currently available data, there is no potential, certainty level D for oil or gas resources beneath Zwagg Island.

Table 1. Chemical analyses of rock samples from Zwagg Island, Ore.

Six-step semiquantitative emission-spectrographic method of Grimes and Marranzino (1968); M.S. Erickson, analyst, U.S. Geological Survey (USGS), Denver, Colo. (first three rows). Au analyzed using atomic absorption method of O'Leary and Meier (1986); Philip Hageman, analyst, USGS, Denver, Colo.; Hg analyzed using atomic absorption method of Crock and others (1987); Eric Walsh, analyst, USGS, Denver, Colo. As, Zn, Cd, Bi, Sb analyzed using atomic absorption method of O'Leary and Viets (1986); F.W. Tippitt, analyst, USGS Denver, Colo. (fourth row). Sample locations shown on fig. 2. Fe, Mg, Ca, and Ti reported in percent; other elements reported in parts per million (ppm). Lower limit of determination of each element is in parentheses. N= not detected; L = detected, but below limit of determination.

		Semiquantitative emission-spectrographic analyses										
Sample No.	Rock Type	Fe (0.05)	Mg (0.02)	Ca (0.05)	Ti (0.002)	Mn (10)	Ag (0.5)	As (200)	Au (10)	B (10)	Ba (20)	Be (1)
1	Sandstone	3	2	0.5	1	500	N	N	N	70	1000	1.5
2	Siltstone	3	1.5	0.5	1	700	N	N	N	50	300	1
		Bi (10)	Cd (20)	Co (5)	Cr (10)	Cu (5)	La (20)	Mo (5)	Nb (20)	Ni (5)	Pb (10)	
1	Sandstone	N	N	20	100	30	50	N	L	30	30	
2	Siltstone	N	N	7	150	50	30	N	N	50	20	
		Sb (100)	Sc (5)	Sn (10)	Sr (100)	V (10)	W (50)	Y (10)	Zn (200)	Zr (10)	Th (100)	
1	Sandstone	N	20	N	150	100	N	20	L	150	N	
2	Siltstone	N	15	N	150	150	N	15	L	100	N	
		Atomic absorption analyses										
		Au (0.05)	Hg (0.02	As (10)	Zn (5)	Cd (0.1)	Bi (1)	Sb (2)				
1	Sandstone	N	0.30	L	50	N	N	N				
2	Siltstone	N	0.02	20	100	N	N	N				

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APPENDIXES

DEFINITION OF LEVELS OF MINERAL RESOURCE POTENTIAL AND CERTAINTY OF ASSESSMENT

LOW mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics define a geologic environment in which the existence of resources is permissive. This broad category embraces areas with dispersed but insignificantly mineralized rock as well as areas with few or no indications of having been mineralized.

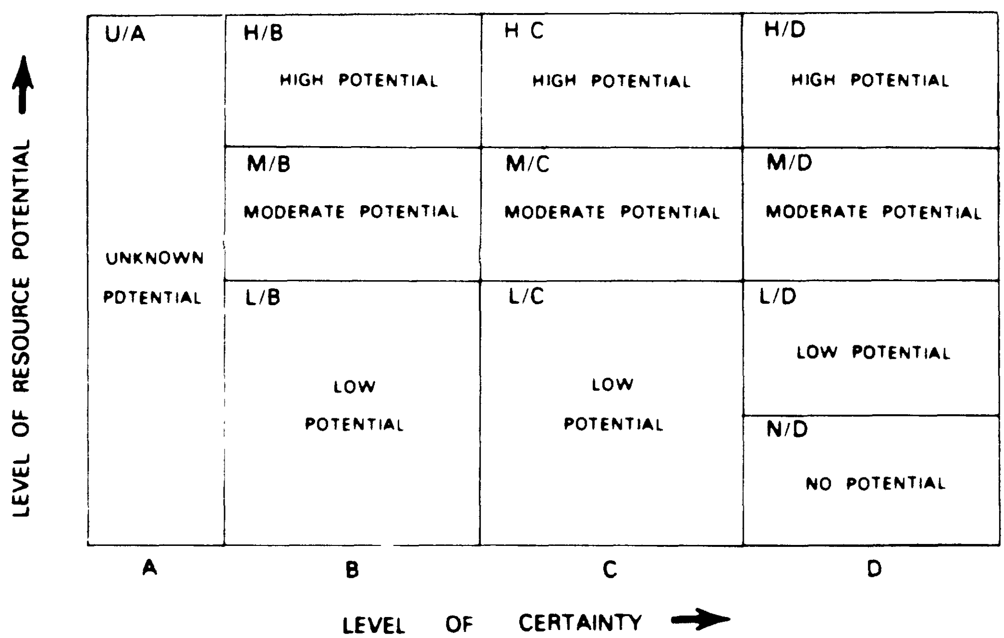
MODERATE mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurrence, where interpretations of data indicate reasonable likelihood of resource accumulation, and (or) where an application of mineral-deposit models indicates favorable ground for the specified type(s) of deposits.

HIGH mineral resource potential is assigned to areas where geologic, geochemical, and geophysical characteristics indicate a geologic environment favorable for resource occurence, where interpretations of data indicate a high degree of likelihood for resource accumulation, where data supports mineral-deposit models indicating presence of resources, and where evidence indicates that mineral concentration has taken place. Assignment of high resource potential to an area requires some positive knowledge that mineral-forming processes have been active in at least part of the area.

UNKNOWN mineral resource potential is assigned to areas where information is inadequate to assign low, moderate, or high levels of resource potential.

NO mineral resource potential is a category reserved for a specific type of resource in a well-defined area.

Levels of Certainty



A Available information is not adequate for determination of the level of mineral resource potential

B Available information suggests the level of mineral resource potential

C Available information gives a good indication of the level of mineral resource potential

D. Available information clearly defines the level of mineral resource potential

Abstracted with minor modifications from:

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RESOURCE/RESERVE CLASSIFICATION

	IDENTIFIED RESOURCES			UNDISCOVERED RESOURCES	
	Demonstrated		Inferred	Probability Range	
	Measured	Indicated		Hypothetical	Speculative
ECONOMIC	Reserves		Inferred Reserves		
MARGINALLY ECONOMIC	Marginal Reserves		Inferred Marginal Reserves		
SUB-ECONOMIC	Demonstrated Subeconomic Resources		Inferred Subeconomic Resources		

. Major elements of mineral resource classification, excluding reserve base and inferred reserve base. Modified from V.E. McKelvey, 1972, Mineral resource estimates and public policy: American Scientist, v. 60, p. 32-40; and U.S. Bureau of Mines and U S. Geological Survey, 1980, Principles of a resource/reserve classification for minerals: U.S. Geological Survey Circular 831, 5 p

GEOLOGIC TIME CHART

Terms and boundary ages used by the U.S. Geological Survey in this report

EON	ERA	PERIOD		EPOCH	AGE ESTIMATES OF BOUNDARIES (in Ma)
Phanerozoic	Cenozoic	Quaternary		Holocene	0.010
				Pleistocene	1.7
		Tertiary	Neogene Subperiod	Pliocene	5
				Miocene	24
			Paleogene Subperiod	Oligocene	38
				Eocene	55
				Paleocene	66
	Mesozoic	Cretaceous		Late	96
				Early	138
		Jurassic		Late Middle Early	205
		Triassic		Late Middle Early	~240
	Paleozoic	Permian		Late Early	290
		Carboniferous Periods	Pennsylvanian	Late Middle Early	~330
			Mississippian	Late Early	360
		Devonian		Late Middle Early	410
		Silurian		Late Middle Early	435
		Ordovician		Late Middle Early	500
		Cambrian		Late Middle Early	~570[1]
Proterozoic	Late Proterozoic				900
	Middle Proterozoic				1600
	Early Proterozoic				2500
Archean	Late Archean				3000
	Middle Archean				3400
	Early Archean				(3800 ?)
pre Archean[2]					4550

[1]Rocks older than 570 Ma also called Precambrian, a time term without specific rank

[2]Informal time term without specific rank