THE GOLD AND RARE EARTH BEARING PLACER DEPOSITS FOUND ON THE LEON DE ORO AND TORO DE ORO CLAIMS, URUBAMBA AND YANATILLI RIVERS, DEPARTMENT OF CUZCO, PERU

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ABSTRACT: The Leon de Oro and the Toro de Oro claims in central Peru have been evaluated and explored by several mining companies, Peruvian and international agencies since 1981. These investigations have discovered in the river sediments mineral resources and reserves of gold, rare earths, zircon and ilmenite.

Leo Bacher and Compañía Minera Intercontinental, S.A., are the holders of the mining rights to twelve denuncios (claims) on the Urubamba and Yanatilli rivers in central Peru. These claims control 48 kilometers of river channel. The floodplain averages 200 - 300 meters wide, with a range of 30 to over 1,000 meters in width. The climate is tropical, with a topography of high mountains surrounding the river valley.

The infrastructure in the area is moderately developed, with all weather road access to the property and a railroad terminus, electricity, and telephones in the nearby town of Quillabamba. Local labor costs are inexpensive, and most necessary supplies are available locally or in Lima.

The regional geology consists of Paleozoic metasediments, 3 to 5 kilometers thick, that have been intruded and deformed by felsic plutons of late Paleozoic, Mesozoic, and Tertiary ages. Associated with the plutonic activity was precious and base metal mineralization in several types of deposits. The rivers have a watershed of approximately 30,000 square kilometers above the claims. Besides the gravels of the floodplains, large paleoterraces remain on the canyon sides. The river gravels are sorted into five sizes, and are very low in clay content, high in sand and have a average maximum boulder size of 3 feet in diameter. The rivers are braided and lay down the sediments as point bar deposits. On the property the rivers have a average gradient of 5 meters per kilometer and a average width of 50 meters.

Gold mineralization is as small flakes, usually less than 2 mm in size, and are disseminated in a fairly homogeneous manner throughout the river gravels. The gold has a fineness of 0.93 to 0.96, and grades for the gold can range from 0.03 to 6 grams per cubic meter of bank run gravel. The gravels also contain 0.4 to 1% zircon which have rare earths and zirconium. The rare earths have a tenor that is apparently unique, with a 30 to 35% heavy rare earth content, versus the typical rare earth deposits tenor having only 1 to 7% heavy rare earth content. The last mineral of economic interest in the gravels is ilmenite. This mineral comprises 0.6 to 1.5% of the bank run gravels.

The geologic resource of the property, including both the floodplain gravels and the paleoterraces, would be a minimum of 472,500,000 cubic meters of gravel grading 0.25 grams gold and 3% heavy minerals per cubic meter. The possible reserve of the property would be 115,000,000 cubic meters of gravel of the same grade.

This property was initially looked at solely for its value in gold. With time it was realized that the property's values in other minerals were much higher than the gold, and when combined together all of these minerals give this property a favorable economic outlook in comparison to other placers that are currently in production in Peru. This property has sufficient resources and reserves to merit further development work.

RESUME : Les placers de León de Oro et de Toro de Oro (Pérou central) ont été explorés et évalués par plusieurs compagnies minières ainsi que des bureaux de recherche péruviens ou internationaux depuis 1981. Ces recherches ont montré l'existence d'or, de terres rares, de zircon et d'ilmenite.

Leo Bacher et la Compañía Minera Intercontinental S.A. sont les plus anciens concessionaires (12 concessions) dans les vallées de l'Urubamba et du Yanatilli. Ces placers s'étendent sur 48 km le long de la rivière. La plaine d'inondation est longue de 200 à 300 mètres en moyenne avec des extrêmes de 30 à plus de 1000 m. Le climat est tropical et une topographie de haute montagne longe la vallée.

Les infrastructures sont moyennement développées : routes praticables par tous temps vers la propriété, terminus de chemin de fer, électricité et téléphone á Quillabamba, la ville la plus proche. Le coût du travail local est bon marché, et l'on peut se procurer la plupart des fournitures nécessaires sur place ou à Lima.

Des métasédiments paléozoïques, épais de 3 à 5 km, qui ont été intrudés et déformés par des plutons felsiques d'âge tardi-paléozoïque, mésozoïque et tertiaire affleurent largement. Sous plusieurs types de dépôts, la minéralisation de métaux précieux et de métaux de base a été associée à l'activité plutonique. Les rivières ont un bassin versant d'environ 30 000 km^2 en amont des concessions. En plus des graviers des plaines d'inondation, il reste de grandes paléoterrases sur les versant des canyons. Les graviers de rivière sont répartis en cinq classes granulométriques et contiennent peu d'argile, beaucoup de sable et ont une dimension moyenne de blocs de 3 pieds de diamètre. Les rivières sont anastomosées et déposent les sédiments en "point bars". Sur la concession, les rivières ont une pente moyenne de 5 m par kilomètre et une largeur moyenne de 50 m.

La minéralisation d'or se présente sous forme de petites paillettes, dont la dimension est généralement inférieure à 2 mm. Elles sont disséminées de façon très homogène dans les graviers alluviaux. L'or a une finesse de 0,93 à 0,96, et la teneur en or peut aller de 0,03 à 6 g par mètre cube. Les graviers contiennent aussi 0,4 à 1% de zircon contenant des terres rares et du zirconium. La teneur en terres rares est apparemment unique : 30 à 35% de terres rares lourdes, alors que les dépôts de terres rares typiques en contiennent seulement 1 à 7%. Le dernier minéral d'intérêt économique contenu dans les graviers est l'ilménite (0,6 à 1%).

Les ressources géologiques de la concession, en tenant compte à la fois des graviers de plaine d'inondation et des paléoterrasses, seraient au minimum de 472 500 000 m^3 de graviers avec une teneur de 0,25 g d'or et 3% de minéraux lourds par mètre cube. La réserve possible de la propriété serait de 115 000 000 m^3 de graviers de même teneur.

Cette propriété n'a été considérée au départ que pour sa valeur en or. On s'est rendu compte, avec le temps, que les valeurs d'autres minéraux étaient plus grandes que celles de l'or, et que l'ensemble de ces minéraux donne à la concession une perspective économique favorable par comparaison avec d'autres placers communément exploités au Pérou. Cette propriété a des ressources et des réserves suffisantes pour mériter un travail de développement ultérieur.

INTRODUCTION

The following report was compiled with information from the Peruvian Instituto Geológico, Minero y Metalúrgico, Compañía Minera Intercontinental, S.A., reports from companies that have leased the property from Compañía Minera Intercontinental, and from

months of work on the property in 1987 and 1988. This report summarizes pertinent criteria for a dredging operation on the placer deposits and gives geologic resources and possible reserves from a data base of over 5,000 cubic meters of gravel sampled and processed.

THE STUDIED AREA.

The placer deposits are controlled by twelve denuncios or claims, comprised of the five Leon de Oro and the Seven Toro de Oro claim groups. They form a contiguous claim block 48 km long containing 5,232 hectares (11,510 acres) of land. The claims are on the eastern side of the Andes mountains, 450 km east of Peru's capital city of Lima (fig. 1). The nearest major city is Cuzco, 150 km to the southeast, and the nearest town of over 5,000 people is Quillabamba, 46 km to the south of the southernmost claim. The claims are in the district of Echarate, the province of La Convención, in Cuzco department, Peru.

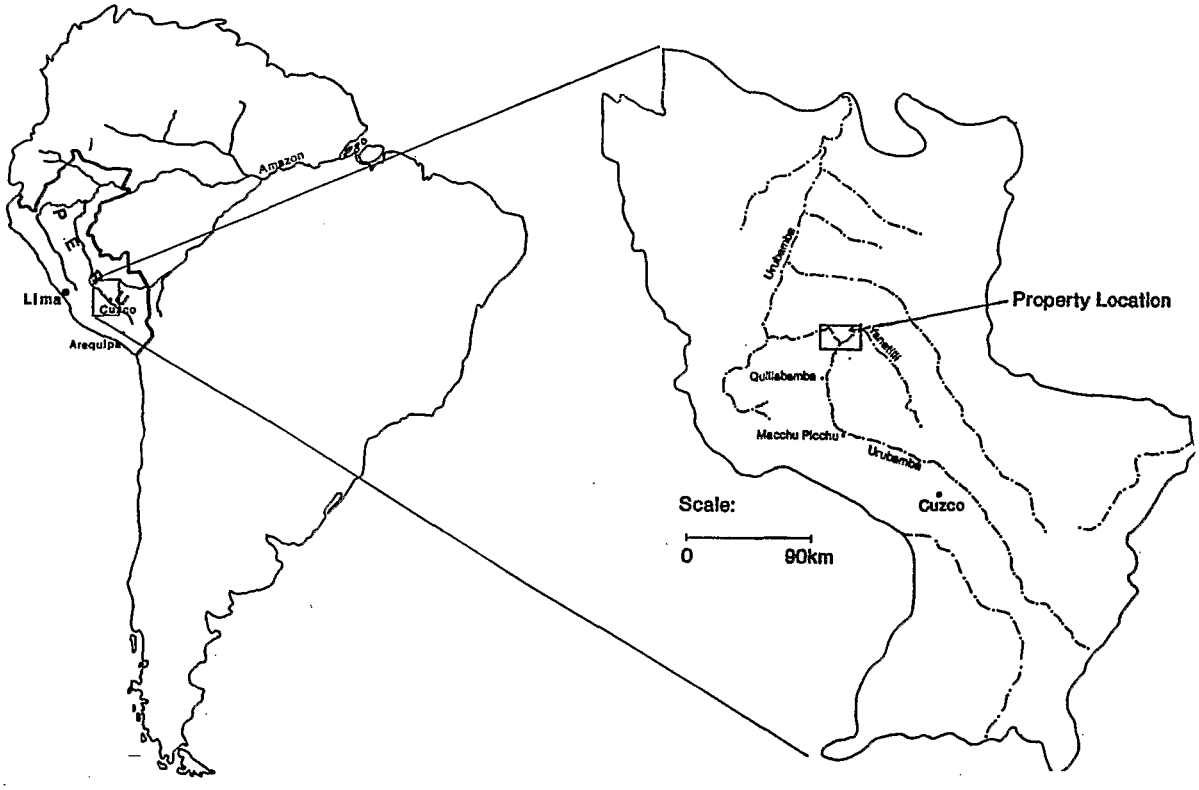

Fig. 1: Map of the department of Cuzco (Peru).

The topography around the claims is quite rugged, steep to almost vertical mountains with 1,000 to 2,000 meters of vertical relief bound the Urubamba and Yanatilli valley floors. The flood plains are generally 200 to 400 meters wide and lie at an elevation of 800 meters. From steep and narrow side canyons strong streams that flow into the main valley have deposited thick alluvial fans that have covered or intermixed with older river terraces.

The climate is tropical with more than 40 inches of annual rainfall and vegetation is typical of the upper Amazon Basin. A rainy season lasts from December to March; the dry season is remainder of the year. Temperatures have averages of 25 - 30 degrees centigrade.

During the rainy season, travel by roads sometimes can be delayed by flooded streams, landslides, and fallen trees.

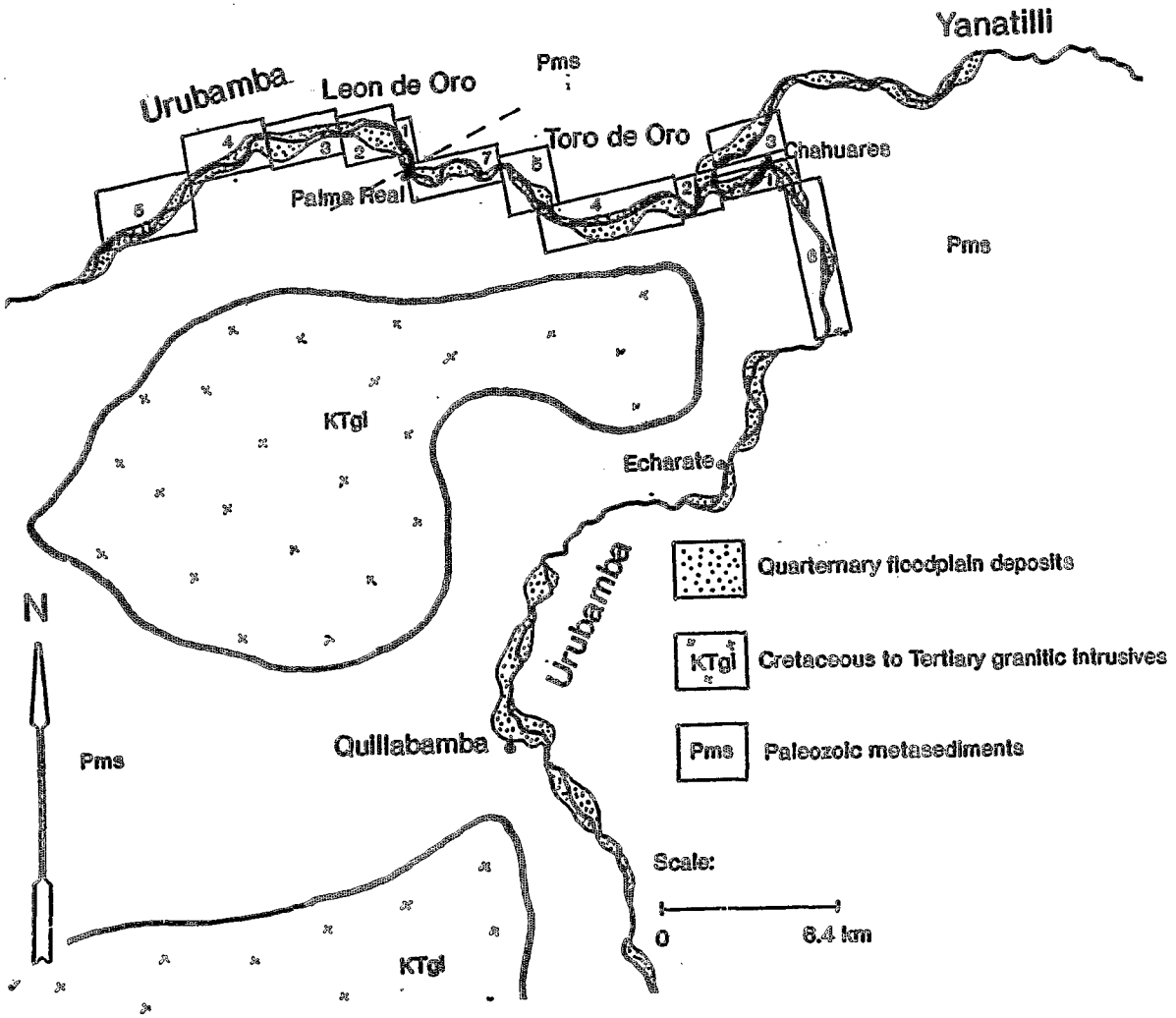

Fig. 2: Claims location and local geology.

The local Quechua and Machiganga Indians have panned gold from the Urubamba and Yanatilli rivers for thousands of years. The area was not settled by the Spanish until the mid-1800's. There have been no mechanized mining operations in the claim area, but small tonnage, underground precious and base metal mines have operated earlier in this century. Local residents continue to use basic panning and sluicing methods for collecting gold from the rivers.

Approximately 20 years ago, the army built an all weather gravel road from Cuzco through Quillabamba and north to Pongo Manineque to control this region. This, along with the breakup of the hacienda system in the late 1960's, promoted the growth of small farms in the area of the claims.

Mr. Leo Bacher, a construction engineer from Waco, Texas, was in Peru looking for favorable gold placers in 1980 and 1981. He acquired the seven Toro de Oro claims in 1981 after finding good gold values and formed Compañía Minera Intercontinental, S.A. (fig. 2). In 1983, Superior Oil Company picked up an option on the claims and planned to develop a

10,000 cubic meter/day dredging operation (Shafer, 1983). Overseas buyers for the planned concentrates and railroad contracts for shipping were arranged. Mobil Oil took over Superior Oil that year, however, and Mobil pulled Superior out of the mining business. Three other small mining companies acquired leases on the Toro de Oro and Leon de Oro claims (staked in 1985) between 1984 and 1988. Each company started the initial contracts for production but had to shut down for lack of funds after a minimum of work.

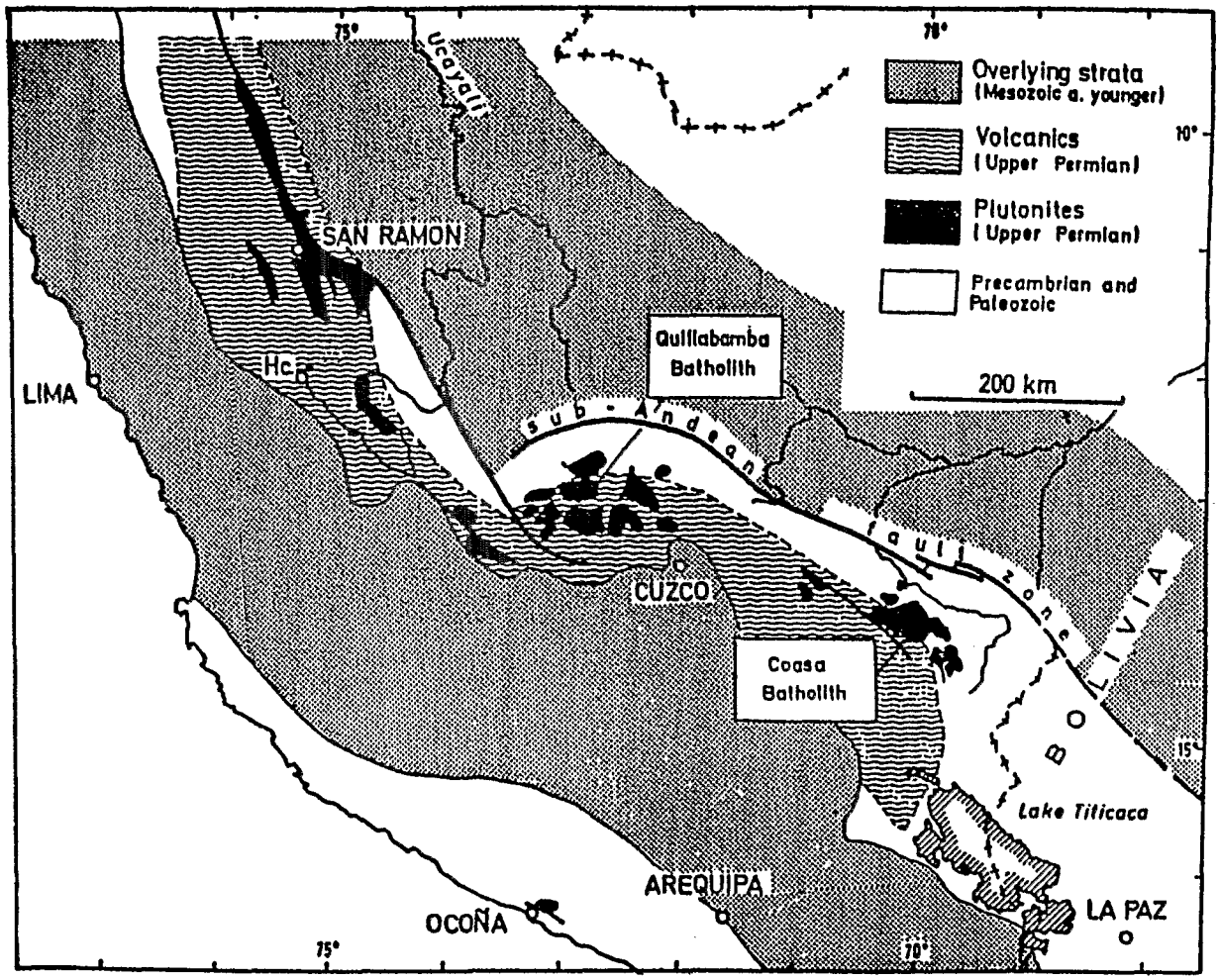

Fig. 3: Distribution of Upper Paleozoic volcanic and plutonic rocks in the Andes of southern Peru. According to Lancelot et al. (1978).

GEOLOGY

GEOLOGICAL BACKGROUND

The gold and rare earth bearing placers of the property were formed in the eastern part of the Andean cordillera bordering the Amazon basin (fig. 3). The oldest known rocks formed in the Area are Early to late Paleozoic metasediments. These are partially metamorphozed shales, siltstones, cherts, limestones, and sandstones, which are often rich in hydrocarbons.

They form an assemblage very similar to that seen in equal aged formations in the western Great Basin region of the USA. The three to five km thick metasediments were deposited along the strike of a miogeosyncline paralleling that of the modern Andean cordillera. The source area of the Paleozoic metasediments was to the east, from the Precambrian continental craton.

Later, during the orogenies that formed the Andean Cordillera, numerous large, synorgenic plutons of Permian, Mesozoic and Tertiary granites, monzonites, and granodiorites have intruded through the Paleozoic metasediments in the area of the Urubamba and Yanatilli river drainages (fig. 2). These plutons form the Quillabamba batholith and were uplifted in various phases during the Tertiary. The intrusion of the plutons and the general uplift of the Andean Cordillera caused deformation, metamorphism and thrust faulting of the Paleozoic sediments. With time erosion has exposed the plutons from the sediment cover.

Numerous small base metal and auriferous quartz vein systems occur in both the plutons and the metasediments. In addition, pophyry, skarn, and disseminated precious metal types of mineralization have been observed by the author in the region. It is probable that most of theses types of mineralization are related to the plutonic activity in the area, but there also could be syndepositional mineral deposits in the Paleozoic metasediments (Heyl, 1988a).

PLACER GEOLOGY

The Urubamba and Yanatilli river canyons probably originated in the early Tertiary time. Regional uplifting and glaciation through the Tertiary has aided the rivers in cutting large, one to three km deep canyons into the country rock. The two rivers above the claims have a watershed area of approximately 30,000 square km, with the Urubamba headwaters more than 300 km to the south, at a elevation of over 6,000 meters (fig. 1). Changes in the rate of uplift and in the climate have also changed the rate of erosion, alternately switching the rivers from agrading to degrading. This change in erosion rates created large paleoterraces. Some terraces, abandoned by the rivers, remain on the sides of the canyons. One large paleoterrace near the village of Chahuares measures one km long by one half km wide and one quarter km high, and contains over 100,000,000 cubic meters of auriferous gravels (fig. 2). These terraces are commonly well concealed by vegetation and landslides.

The width of the floodplains increases downriver, from an average of 200 meters at the south end of the property to an average of over 400 meters at the northwest end of the property. The range in floodplain width is from 30 to over 1,000 meters. The average depth to bedrock is unknown but it should be at least ten meters (Ramierez, 1985b).

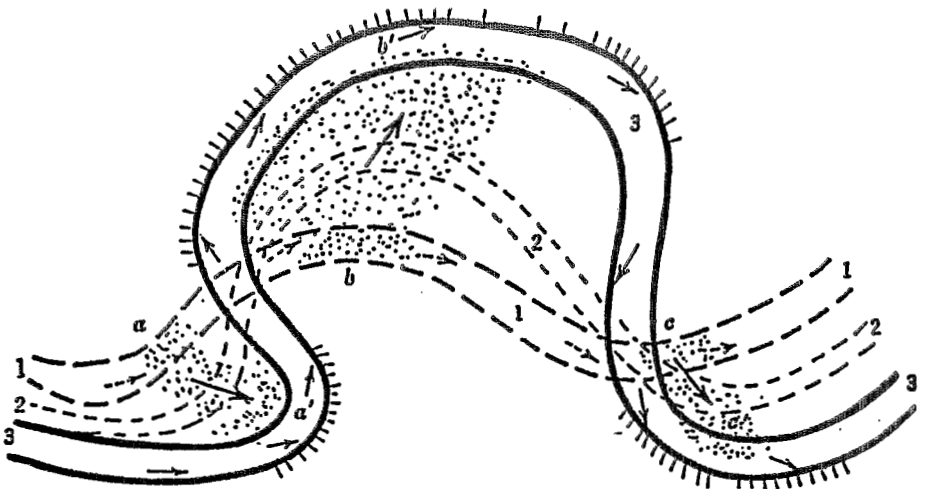

Fig. 4: The meandering of rivers and the location of gold deposition.

The sizing of the river sediments changes rapidly downriver. At Quillabamba, 46 km upriver from the southern claim boundary, the size of the largest boulders averages 1 2/3 meter in diameter (fig. 2). In the northern claims, this maximum size has decreased to 1 meter in diameter. At the Leon de Oro N° 2, 30 km downstream from the upper claims, this average maximum size has further decreased to 1/3 meter in diameter. The river sediments have five sorting sizes, all rounded to well-rounded. Thirty percent of the river sediments are large cobbles, 12 cm or larger in diameter, with twenty percent of this fraction flattened by erosion. The next size fraction is coarse pebbles, 1 cm to 8 cm in diameter, containing 15% of the river sediments. Of the coarse gravels, 40% are flattened. The fine pebble fraction contains 25% of the sediments, and are 2 mm to 1 cm in diameter. This fraction is 70% flattened. Sand and silt, less than 10% flattened. The last sorting size is clay, and it comprises 1% or less of the river sediments, making the river sediments clay poor (Heyl, 1988b).

The sediments composition changes with the sorting sizes. The large cobble sized fraction is 40% plutonic, 55% metasediments, and 5% quartz vein. The coarse pebble fraction has the same compositional percentages as the first fraction. The fine pebble fraction is 70% metasediments, 25% plutonic, and 5% quartz vein. The sand and silt fraction is composed of 10% rock fragments, 35% quartz, 35% feldspars, 5.5% magnetite, 2% ilmenite, 1.5% zircon, and 11% various other minerals (Heyl, 1988b, & Ramierez, 1985c).

The rivers are braided and meander on the floodplain, with sediments being deposited as point bars (Hilchey, 1988). The rivers continually erode the outside curves of their meanders, and continually deposit sediments on the inside curves (fig. 4). This process of erosion and deposition creates a river channel that becomes more serpentine with time. Occasionally during major floods the rivers jump their banks on the floodplain and start a new, straighter main channel. It is also during major floods when thick deposits of sand and silt, without the larger fractions, are deposited on the floodplain. The cobble and pebble sized fractions are usually deposited in a slanted manner, so that the lower part of the stone is pointed upstream, parallel to the flow of the water (Heyl, 1988b).

The river sediments are cemented poorly due to the low clay content. The paleoterraces, however, which have been exposed to air over a long period of time, are partially cemented by limonite and hematite. These iron oxides are derived from magnetite, ilmenite, and pyrite found in the country rock and quartz vein fragments.

Above the confluence of the Urubamba and Yanatilli rivers, the Urubamba river averages 30 meters wide and the Yanatilli averages 15-20 meters wide. Below their confluence the Urubamba averages 50 meters wide. The river gradient at the property is about 5 meters per km, in comparison to upriver where it averages 20 meters per km. This change in gradient, along with the formentioned widening of the floodplain, has created a sediment trap below the confluence of the river. The river elevations can fluctuate 3-5 meters with the seasons, but during both the dry and rainy seasons there are areas that can be worked by mechanized equipment.

THE MINERALIZATION

THE GOLD MINERALIZATION

Fine-sized gold flakes are found distributed throughout the river gravels on the property (Heyl, 1988a; Shafer, 1983). Results of seven years of sampling and processing over 5,000 cubic meters of volume of the property's gravel's during that period of time have established an average, minimum bank run grade of 0.1 g gold per cubic meter of gravel. The lowest grades reported were 0.02 to 0.03 g gold per cubic meter. Local miners achieve an average bank-run grade of 0.5 to 1.0 g gold per cubic meter by mining in higher grade areas,

sometimes with grades of 2 to 6 g gold per cubic meter. Companies that have operated on the property report mining in areas runing 1 to 2 g gold per cubic meter, and usually with the gold grades increasing with depth (Sampsell, 1984). This I can confirm by personal experience. However, little testing has been done below two meters depth, and no testing has been done below four meters depth. Thus, the deeper gravels potential grade of gold is unknown. Until additional data from is collected, the possible grade of gold for the property's floodplains, based on companies and governmental records, should be put at 0.25 g gold per cubic meter. The geologic resource grade of gold for the property's floodplains should be 0.5 g gold per cubic meter.

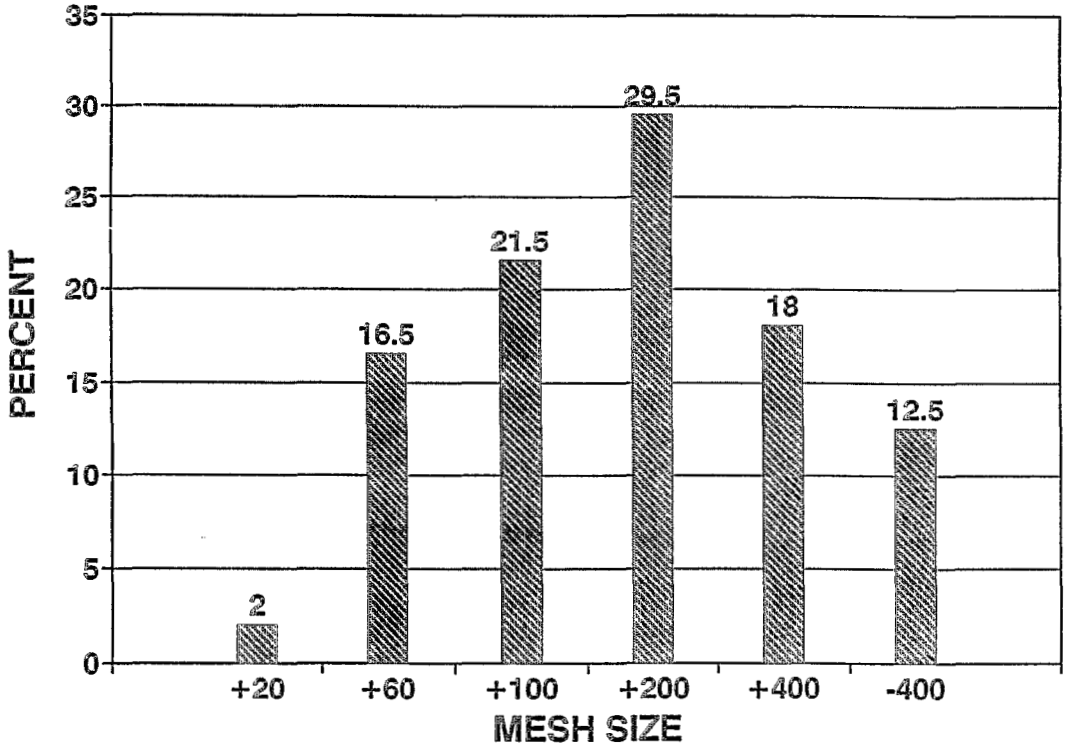

Fig. 5: Gold particle size distribution (Urubamba).

The gold particles usually are flattened flakes less than 20 mesh, with abundant particles less than 60 mesh in size (fig. 5). The size fraction of -100 to +200 mesh has 29.5% of the total weight of the gold (Heyl, 1988a; Sampsell, 1984). The gold has a fineness of 0.93 to 0.96 (Sampsell, 1984). The gold occurs in both sands and gravels and is often found in higher grade zones, usually at the upstream point of any of the rivers point bar deposits.

The abandoned gravel terraces also contain gold, but insufficient testing of the terraces does not permit a more definite grade than that of a geologic resource at 0.1 g gold per cubic meter.

HEAVY MINERAL SANDS CONTAINING RARE EARTHS

The Urubamba and Yanatilli rivers sands and gravels contain a small amount of heavy mineral grains. These "black sands" contain valuable metals in economic grades. The property's heavy mineral sands are found in a range of 1 to 10% of the bank run volume. The possible grade for the heavy mineral sands is 3% of the bank run volume. The geologic

resource grade is 5% of the bank run volume. The heavy mineral sands usually are less than 0.5 mm (-40 mesh) in diameter, and not rounded by erosion (Heyl, 1988b).

The percentages of the potential, economically recoverable minerals in the heavy mineral sands (Heyl, 1988b) include 40% magnetite (iron), 20% ilmenite (titanium), and 15% zircon (rare earths, zirconium and thorium). The other minerals that comprise the remaining 25% of the heavy mineral sands include rutile, wolframite, apatite, monazite, sphene, cassiterite, augite, pyrite, hematite, and hornblende (fig. 6), (Heyl, 1988a; Ramierez, 1985c).

Rare earth oxides comprise 0.1 to 0.4% of the heavy minerals by weight, with a possible grade of 0.2% of the heavy mineral sands weight (fig. 7), (Maki, 1988). The rare earths are contained in the minerals apatite, monazite, sphene, and most importantly, zircon (Ramierez, 1985a). The property's rare earths have a unique aspect in their tenor (percentages of elements in relation to one another) in comparison to the published grades of other rare earth deposits in the world.

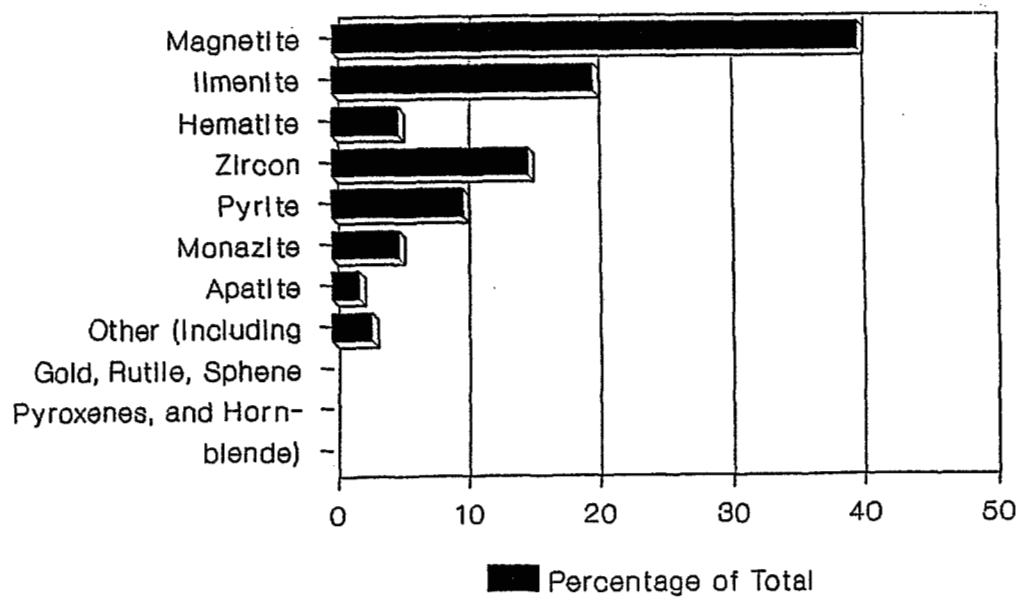

Fig. 6: Composition of heavy mineral sands.

The 16 rare earth elements are divided by industry into two groups, the light rare earths (La, Ce, Pr, & Nd) and the heavy rare earths (Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, & Y). The two main types of rare earth deposits mined today, bastnaesite and beach sands containing monazite and apatite, respectively contain heavy rare earths in tenors of 1 to 2% and 3 to 7%. In comparison, the property's rare earths have a heavy rare earth tenor of 31 to 36% (fig. 8). The value at present market prices for the rare earth oxides, with a possible grade of 0.2% of the heavy mineral concentrates, is $ 4,50 per cubic meter of bank run gravel.

Zircon is the main mineral carrying values of rare earths, and the zircons also contain the element zirconium. The zircons have a possible grade of 0.46% of the bank run volume. The zircons are euhedral and transparent with a pink or white color, and are derived from the plutons of the Quillabamba batholith. The value for the zircons at present market prices and at the possible grade is $ 6.51 per cubic meter of bank run gravel.

The remaining mineral of main economic interest is ilmenite, which is an ore of titanium and has a possible grade of 0.6% of the bank run gravel. The value for the ilmenite at present market prices and at the possible grade is $ 1.20 per cubic meter of bank run gravel.

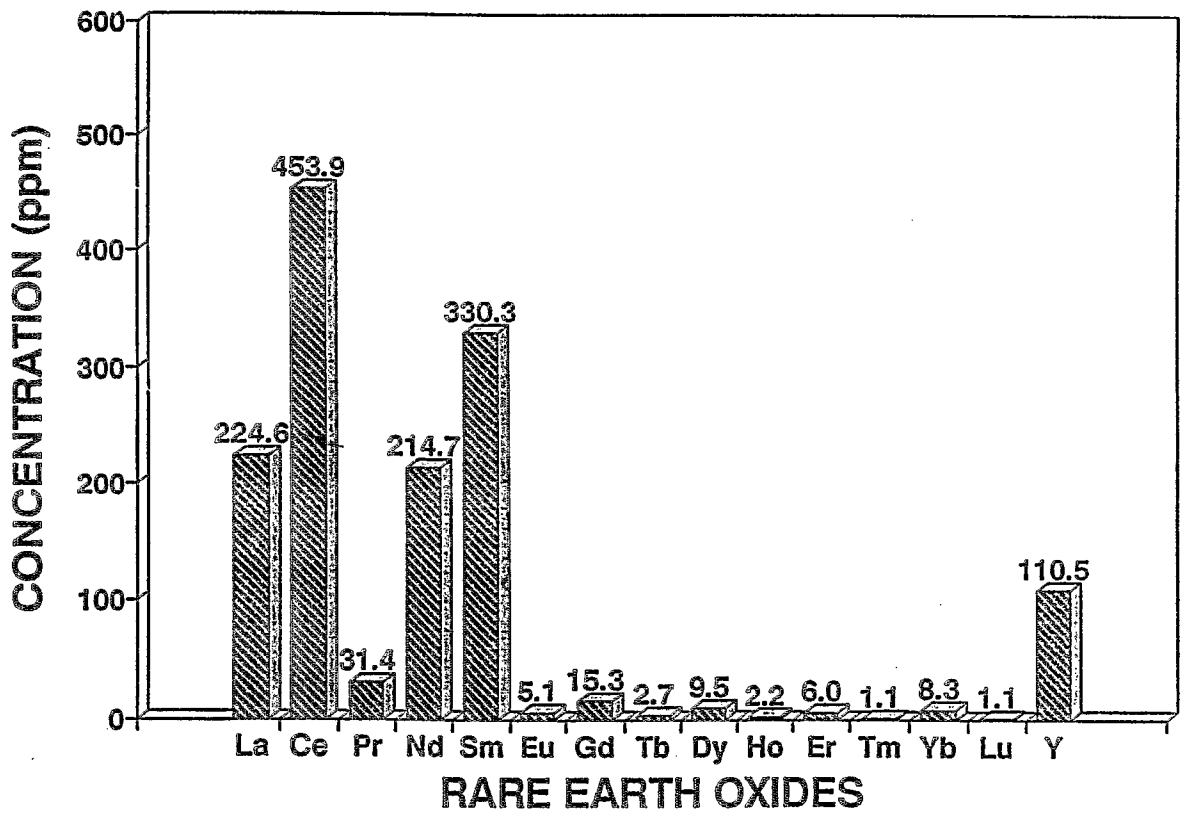

Fig. 7: Rare earth oxides in heavy mineral sand (Typical Urubama).

RESOURCES AND RESERVES

The resources and reserves of the property are contained in an area of 48 km in lengthand up to one km in width (fig. 2). The Toro de Oro claims have an area of 3,026 hectares (7,478 acres). Within them are a volume of auriferous floodplain gravels measuring 29 km long, 200 meters wide, and 10 meters deep containing 58,000,000 cubic meters of bank run gravel. The Leon de Oro claims have an area of 2,206 hectares (5,451 acres). Within them are a volume of auriferous floodplain gravels measuring 19 km long, 300 meters wide, and 10 meters deep,containing 57,000,000 cubic meters of bank run gravel.

The large size of the property and the constant changing of companies leasing the property have restrained the amount of evaluative work that has been done on the property. Sampling and production of the floodplains mainly has been confined to limited, intensively worked areas separated by distances of one half to five km. This work has proven ore reserves in several small blocks of measured dimensions with a total volume of 1,900,000 cubic meters of bank run gravels grading over 0.10 g gold and 3% heavy mineral sands per cubic meter. These reserves were proven by pit excavations on measured grids or by production excavations with varying dimensions, totalling over 5,000 cubic meters in volume of bank run gravels. Both types of excavations were up to 4 meters deep and averaged 2 meters in depth. The proven reserves have not been included in the figures of this report due to their small size in comparison to the total reserves and resources of the property.

In estimating the other ore reserves of the property, it was decided to use the term "possible" in comparison to "probable" due to the lack of data through the entire thickness of the floodplain gravels and the long distances between areas evaluated. It must be said, however, that all the data show a remarkable consistency in the general floodplain gravel composition and the grades of gold contained in them from one area to another of the property. The grade of gold appears to generally increase with depth, also an encouraging sign. The possible reserves are quantitative estimates based on the geologic knowledge of the property and the projection from the proven ore blocks a continuation of grade.

The geologic resource estimates are based on the geologic knowledge of the property but have limited sample and measurement data available and thus inferences must be made as to grades and volumes. The important differences in the estimation for the resources were to infer a greater depth to the floodplain gravels (from 10 to 15 meters), to include the terrace deposits, and to increase the grades for gold and heavy mineral sands.

The possible reserves found on the floodplains consist of 115,000,000 cubic meters of gravel having a bank run grade of 0.25 g gold and 3% heavy minerals per cubic meter (Table 1). The total geologic resource of the property is 472,500,000 cubic meters of gravel having a grade of 0.25 g gold and 3.7% heavy minerals per cubic meter. The total geologic resource is comprised of two types, the floodplain resource (including possible reserves) and the terrace resource. The floodplain geologic resource has 172,500,000 cubic meters of gravels with a grade of 0.5 g gold and 5% heavy minerals per cubic meter. The terrace geologic resource has 300,000,000 cubic meters of gravel grading at 0.1 g gold and 2% heavy minerals per cubic meter.

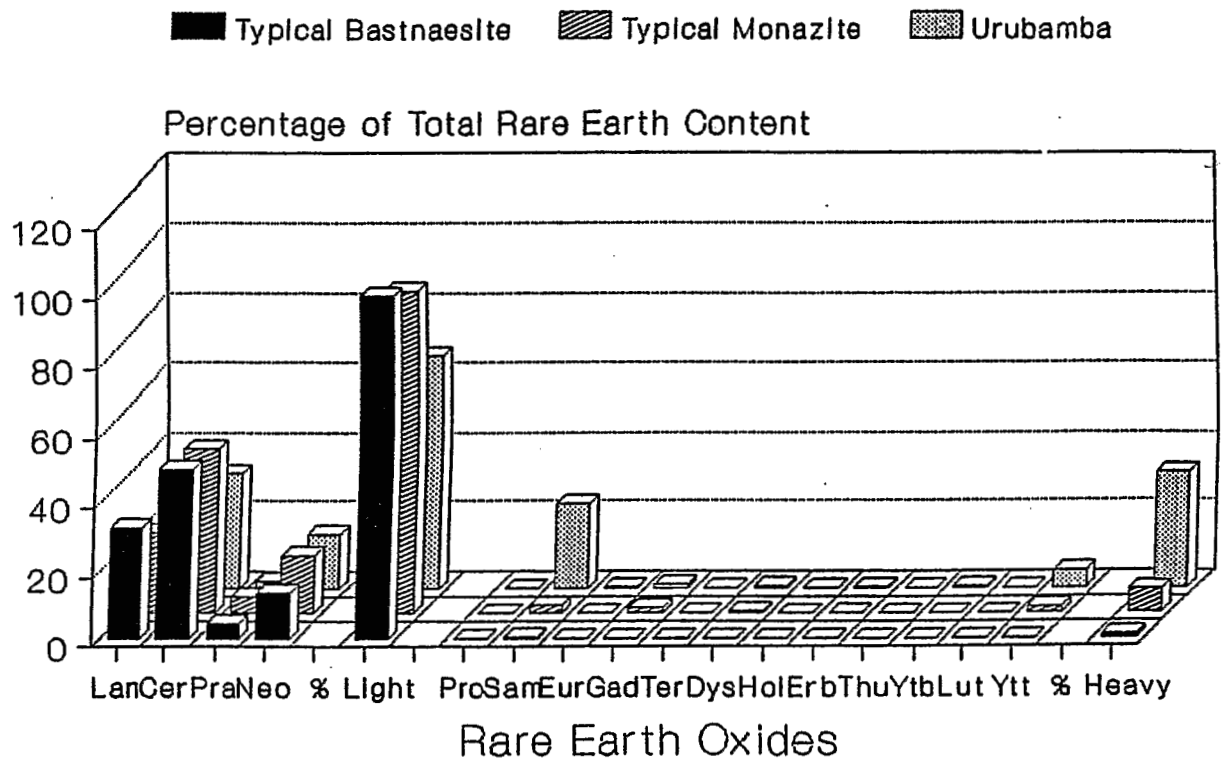

Fig. 8: A comparison of rare earth ore tenors.

The valuations for the reserves and resources was based on the following market prices for the four main mineral products of the property. Gold at US $400.00 per troy ounce, ilmenite at US $67.33 per ton (Mining Journal, 3/2/1990), zircon at US $486.27 per ton

Table 1. Resources and reserves

	CUBIC METERS	AU G/M	% HEAVY
FLOODPLAIN POSSIBLE RESERVES	115,000,000	0.25	3
FLOODPLAIN GEOLOGIC RESOURCES	172,500,000	0.5	5
TERRACE GEOLOGIC RESOURCES	300,000,000	0.1	2
TOTAL GEOLOGIC RESOURCES	472,000,000	0.25	3.7

Fig. 10. Values per cubic meter of bank run (in U.S. dollars)

	GOLD[1]	ZIRCON[2]	RE OX[3]	ILM[4]	TOTAL
FLOODPLAIN: POSSIBLE RESERVES	3.21	6.51	4.50	1.20	15.42
FLOODPLAIN: GEOLOGIC RESOURCES	6.43	10.85	7.50	2.00	26.78
TERRACE: GEOLOGIC RESOURCES	1.29	6.51	3.00	1.20	12.00
TOTAL GEOLOGIC RESOURCES	3.16	8.03	4.64	1.48	17.31

1. AU AT $ 440/OZ
2. ZIRCON AT $ 486.27/TON
3. BASED ON COMPOSITE TENOR
4. ILMENITE AT $ 67.33/TON

Table 2. Total reserve values (in millions of U.S. dollars)

FLOODPLAIN POSSIBLE RESERVES	GOLD	369
	ZIRCON	748
	ILMENITE	138
	RE OXIDE	517
	TOTAL	1,772
FLOODPLAIN GEOLOGIC RESOURCES	GOLD	1,109
	ZIRCON	1,872
	ILMENITE	345
	RE OXIDE	1,293
	TOTAL	4,619
TERRACE GEOLOGIC RESOURCES	GOLD	385
	ZIRCON	1,953
	ILMENITE	240
	RE OXIDE	900
	TOTAL	3,478
TOTAL GEOLOGIC RESOURCES	GOLD	1,495
	ZIRCON	3,795
	ILMENITE	586
	RE OXIDE	2,193
	TOTAL	8,069

(Mining Journal, 3/2/1990), and combined rare earths at US $1,50 per one percent of heavy mineral sand in the bank run gravels (Table 2) (Am. Metal Market, 3/23/1990).

The possible floodplain reserves have a total value of US $15.42 per cubic meter. This value is based on $3.21 in gold, $6.51 in zircons, $1.20 in ilmenite, and $4.50 in rare earth oxides. The floodplain geologic resources have a total value of US $26.78 per cubic meter. This value is based on $6.43 in gold, $10.85 in zircons, $2.00 in ilmenite, and $7.50 in rare earth oxides. The terrace resource has a total value of $12.00 per cubic meter, based on $1.29 in gold, $6.51 in zircons, $1.20 in ilmenite, and $4.50 in rare earth oxides. The total geologic resource value per cubic meter is $17.31. This value contains $3.16 gold, $8.03 zircons, $4.64 in rare earth oxides, and $1.48 in ilmenite per cubic meter of bank run gravel.

The property's reserves and resources are of large value (Table 2). The floodplains possible reserves are valued at US $1.772 billion, containing 922,500 ounces of gold, 1,538,240 tons of zircon, 2,049,605 tons of ilmenite, and 36,857 tons of rare earth oxides. The geologic resource of the floodplain could be in value US $4.619 billion, and the geologic resource of the terraces could be US $3,478 billion. The combined geologic resource of the property could have a value of US $8.069 billion, containing 3,737,500 ounces of gold, 7,865,000 tons of zircon, 10,470,000 tons of ilmenite, and 186,570 tons of rare earth oxides.

CONCLUSIONS

The Leon de Oro and Toro de Oro claims were initially looked at and acquired for solely their potential value in gold. For four years gold was the only valuable mineral thought to be contained in the gravels of the Urubamba and Yanatilli rivers. In 1984, Ingemmet evaluated the heavy mineral sands of the property and found a potentially economic resource of zircon, ilmenite, and rare earths. Since that time, the evaluation process has included those minerals as well as gold. Continual examination of the heavy minerals sands has created a realization that the property's major values were not in the gold, but in the heavy mineral sands. When all of the valuable minerals are combined, it gives the property a highly favorable economic outlook in both total value of the products and in protection from single commodity market price fluctuations.

The property has reserves of similar size and grade in heavy mineral sands as beach placer mines in Australia that are currently in production processing ilmenite, monazite and zircon concentrates. The property also contains reserves of gold of similar size and grade as several gold placer mines currently in production or development in Peru and Bolivia.

The property has sufficient reserves and resources to merit further developmental work. A clearer picture is needed of the true depth and deeper values of the floodplains, and infill work done between the areas tested. Also, much work is needed in the terrace deposits. The blocks of proven reserves should be evaluated for the feasibility of putting them into production. The Urubamba and Yanatilli rivers have deposited large reserves and potentially world-class resources of gold and heavy mineral sands in their valleys, and a consistent, well-planned effort is needed in order to fully recover the wealth contained in those valleys.

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