COMUNICACIONES Nº 50 (1999): 33-37

MORPHOLOGIC EVOLUTION OF TRANSPORTED GOLD NUGGETS IN DIFFERENT CLIMATIC TERRAINS

G. HERAIL[1], C. PALACIOS[2], R. ORELLANA[2], B.TOWNLEY[2], A.LAHSEN[2] AND M.PARADA[2]

[1] IRD, 209-213 Rue La Fayette, 75480 Paris Cedex 10, France
[2] Dept. of Geology Univ. Chile. P.O. Box 13518 Correo 21. Santiago-Chile.

***KEY WORDS**: Gold grains, morphologic evolution, different climates, exploration*

INTRODUCTION

Different studies demonstrate that the morphology of gold grains evolves during transport, as a function of the distance from the source, constituting an effective tool in identifying proximity to the gold-bearing orebodies. Numerous works in different climatic and supergene environments have been reported, however, only few of them have compared the morphologic evolution of transported gold particles in different climatic conditions. Because of rapid climatic and topographic variation in time, gold grains recovered from sediments do not necessarily represent particles liberated and transported in the present supergene environment.

From an exploration viewpoint, considering that the main use of the morphologic evolution of gold grains as a distance to source indicator applies in covered areas, it is considered desirable to have general morphological parameters in gold particles that, independent to the climatic environment, indicate distance to the source.

Regarding the previous problematic, we have compared the morphology of gold particles with respect to the transport and distance from source in arid, semi-arid, humid, lateritic, fluvial, fluvio-glacial and glacial environments.

RESULTS

Having compared the morphological description of more than 12,000 gold particles from different environments in Chile, Bolivia, West Africa and Canada, 4 different ranges of transport distance for gold grains have been defined. The main morphologic features for each defined distance range and environment are presented as follows (table 1):

I. GOLD GRAINS RECOVERED BETWEEN THE OREBODY AND 50 M DOWNSTREAM

This group included the analysis of gold grains from:

a) Weathered gold-bearing quartz veins in lateritic soils and stream sediments down-drainage from the source at Merei, Ivory Coast, West Africa (Grant et al, 1991).

b) Tills from Waddy Lake, Canadian Shield (Averill and Zimmerman, 1986).

c) Deep weathered gold-bearing loads and stream sediments from Las Palmas, Central Chile (Orellana, 1999).

d) Alluvial systems in arid and semi arid environments of northern Chile (Lagos, 1996; Varas, 1996).

The particles maintain their general shape occurring in the orebody: square to rectangular, irregularly stellate, very angular and partially with bays. The outline of the grains is very irregular, exhibiting surfaces with irregular topography. Normally the gold particles exhibit primary crystal imprints and present inclusions of quartz, Fe oxides and/or pyrite. The flatness index (see Herail et al. 1999, this volume) of the grains varies between 1 and 3.

II. GOLD PARTICLES RECOVERED BETWEEN 50 AND 300 M AWAY FROM THE SOURCE

This group was defined using the following data :

a) Glacial terrains from Owl Creek, Ontario, and Waddy Lake, Canadian Shield (Averill and Zimmerman, 1986; Grant et al., 1991)

b) Lateritic environments from Las Palmas, Central Chile (Orellana, 1999).

c) Alluvial systems in arid and semi arid environments of northern Chile (Lagos, 1996; Varas, 1996).

In this distance range the grains exhibit semi-angular shape, regular outline and topography, and normally present quartz inclusions. The flatness index of the gold particles range from 2.1 to 4.6.

III. GOLD GRAINS RECOVERED BETWEEN 300 M AND 1 KM AWAY FROM THE SOURCE.

This distance range considered data from:

a) Till and glacial environments from Waddy Lake, Canadian Shield (Averill and Zimmerman, 1986; Grant et al., 1991).

b) Lateritic environments from Las Palmas, Central Chile (Orellana, 1999).

c) Alluvial systems in arid and semi arid environments of northern Chile (Lagos, 1996; Varas, 1996).

The gold particles are mainly rounded to oval, with common elongated grains. The outline and topography are regular, and the surface exhibits hammered and lifted to folded aspects. The flatness index of the gold particles varies between 3 and 8.6.

IV. GOLD PARTICLES RECOVERED OVER 1 KM AWAY FROM THE SOURCE.

This range group includes data from:

a) Glacial terrains from Waddy Lake, Canadian Shield (Averill and Zimmerman, 1986)

b) Lateritic environments from Laoudi, Ivery Coast, West Africa (Grant et al., 1991).

c) Alluvial systems at Tipnami, Bolivia (Herail et al., 1990)

d) Fluvio-glacial terrains of southern Chile (Ordóñez, 1998).

e) Alluvial systems in arid and semi arid environments of northern Chile (Lagos, 1996; Varas, 1996).

The gold grains are rounded to oval with very regular and polished outlines. The topography of the surface is regular, and commonly exhibits striation and impact marks, and hammered aspect. The flatness index range form 4 to 16.

CONCLUSIONS

Taking into account the morphologic evolution of gold grains during downstream transport in different climatic conditions, the distinctive features which appear as common in each range of transport distance, are the following.

Range of transport distance	Outlines	Surfaces	Inclusions of minerals	Flatness index
0-50 m	Very irregular	Irregular, imprints primary crystal	Quartz, Fe oxides or pyrite	1.0-3.0
50-300 m	Regular	Regular	Quartz	2.1-4.6
300-1,000 m	Regular	Hammered, lifted and folded	———	3.0-8.6
>1,000 m	Very regular and polished	Striation and impact marks, hammered	———	4.0-16.0

Obviously, numerous others features are different in each range of transport distance, depending on the climatic conditions.

ACKNOWLEDGMENTS

The research was supported by the Grants FONDEF 1033 from CONICYT, Chile.

REFERENCES

Averill, S.A. and Zimmerman, J.R. 1986. The Riddle resolved: the discovery of the Patridge gold zone using sonic drilling in glacial overburden at Waddy Lake. Saskatchewan. Can. Geol. J.CIM, 1, 14-20.

Grant, A.H., Lavin, O.P. and Nichol, I. 1991. The morphology and chemistry of transported gold rains as an exploration tool. Jour. Geochem. Expl., 40, 73-94.

Herail, G., Fournari, M., Viscarra, G., and Miranda, V. 1990. Morphological and chemical evolution of gold grains during the formation of a polygenic fluviatile placer: the Mio-pleistocene Tipuani placer example (Bolivia). Chron. Rech. Min., 500, 41-49.

Herail, G., Palacios, C.M., Orellana, R., Townley, B., Lahsen, A. and Parada, M. 1999. Morphologic evolution of gold grains versus distance to the source in recent sediments at the Las Palmas district, Central Chile: An exploration tool. Proc. Int. Symp. on Geochemical and Mineralogical Tracers in Mining Exploration (This volume).

Lagos, J. 1996. La dispersión del oro en sedimentos de ambiente desértico: modalidades e implicaciones para la prospección (Región de Atacama, Chile). Thesis. Dept. of Geology. Univ. of Chile., 115 p.

Ordóñez, A.B. 1998. Comportamiento y origen del oro detrítico a la largo de una franja de la Cordillera de la Costa y Depresión Central entre el río Llico y el Canal de Chacao, X Región, Chile. Msc Thesis. Dept. of Geology. Univ. of Chile, 132 p.

Orellana, R. 1999. Morfoscopía y geoquímica de partículas de oro en ambiente supérgeno (V Región, Cordillera de la Costa, Chile). Aplicación al seguimiento de la dispersión del oro y a la prospección. MSc Thesis. Dep. of Geology. U. of Chile, 132 p.

Vargas, L. 1996. Modalidad de dispersión y caracterización de los granos detríticos de oro de la zona Quebrada Las Palmas, Cordillera de la Costa, IV Región, Chile. Thesis. Dept. of Geology. Univ. of Chile, 152 p.

PHYSICAL CHARACTERISTICS OF THE GOLD PARTICLES		DISTANCE TO THE SOURCE			
		0 - 50 m	50 - 300 m	300 - 1000 m	> 1000
OUTLINE	Regular				
	Very Regular				
	Very Irregular				
	Polished				
	Bent-up				
	Folded				
SURFACE	Regular topography				
	Irregular topography				
	Hammered				
	Impacts				
	Grooves				
	Cavities				
ASSOCIATED MINERALS	Clay and Fe hydroxides				
	Quartz				
	Fe oxide-Pyrite				
	Primary imprints				

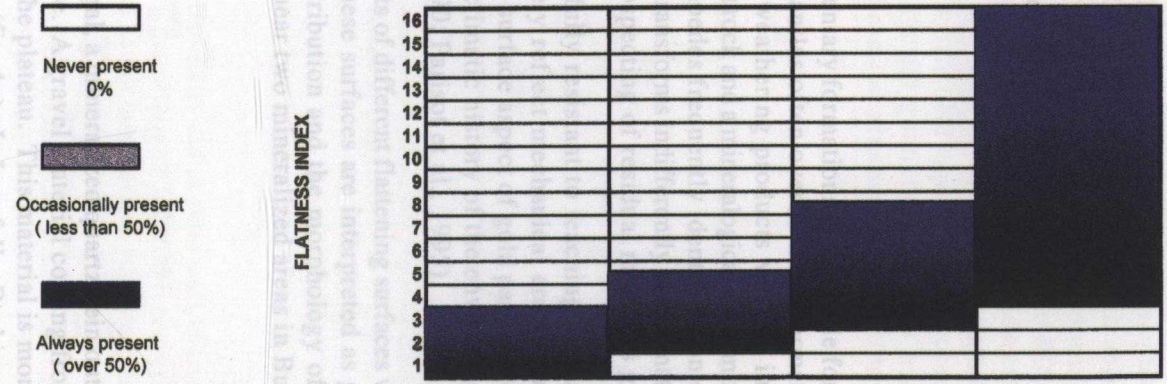

Table 1,- Morphologic evolution of transported gold grains in different climatic terrains