(Jour. Geol. Soc. India, 17, 1976, 279-281)

Ball textures in sulphide ores—an example from Indian deposits

ANANDA DEB MUKHERJEE
Department of Geological Sciences, Jadavpur University; Calcutta
AND
R. SEN
Hindusthan Zinc Ltd., Udaipur, Rajasthan

Abstract

Ball textures in the sulphide ores of Khetri copper belt, Rajasthan are considered to be the result of extreme deformation. The ore in the cases described are considered premetamorphic.

Introduction

Ball textures in sulphide ores were first noticed by Geijer (1971) who described them as an 'extreme phase of deformation'. Vokes (1973) in describing the ball textures from the Norwegian Palaeozoic massive sulphides (Caledonian), extended the origin to the 'extreme deformation of sulphides formed during the pre-orogenic, volcanic-sedimentary stages' in the evolution of the Caledonian geosynclinal belt.

The present appraisal is an attempt at an understanding of the ball texture in Indian sulphide ores not hitherto reported.

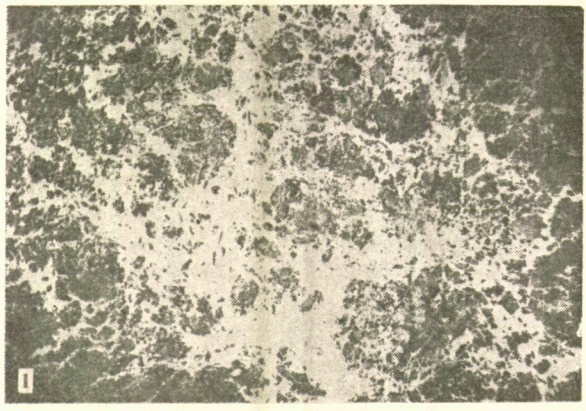
Discussion

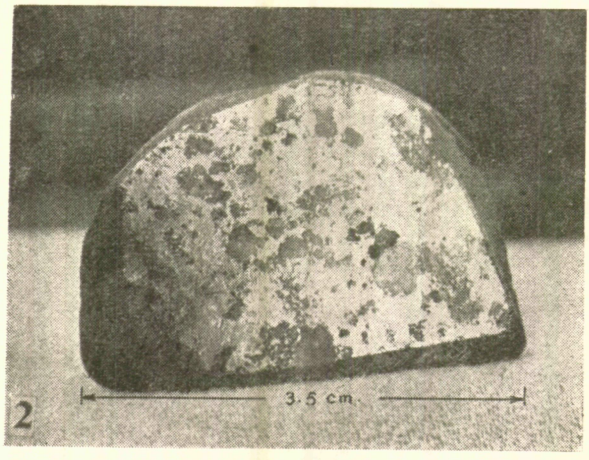
The ball texture has been observed in the Khetri copper belt, Rajpura-Dariba lead-zinc copper belt in Rajasthan, Ambamata-Deri lead-zinc-copper belt in Rajasthan and Gujarat, Agnigundala copper-lead belt in Andhra Pradesh and the Sikkim lead-zinc-copper belt.

The ball textures in the above mentioned sulphide ores can be categorised in two characteristic groups viz:

(i) Association of gangue and sulphides
(ii) Association of sulphide and sulphide

In the above mentioned deposits one can possibly follow the path of deformation from banded ores to 'Ball' ores. At the outset, the deformation starts with tight folding involving both the sulphides and the silicate rich bands. Moderate deformation helps in the retention of conformability of the sulphide and silicate rich bands. As the intensity of deformation increases, the folded silicate rich bands are torn off and the fragments are separated from each other. In fact plastic sulphide mass flows in between these fragments due to increasing deformation. Detached masses of silicates float in an apparently homogeneous mass of sulphides whose banded nature is obliterated due to recrystallisation. Depending on their original form the separated fragments get rounded off to varying degrees as a result of progressively increasing deformation. In this process the unfolded silicate fragments remain elongated to oval in shape while the folded ones, being more compressed assume a spherical shape. Fragments of vein quartz affected by deformation assume well rounded form. A thorough milling (predominated by internal rotation) is necessary for producing such





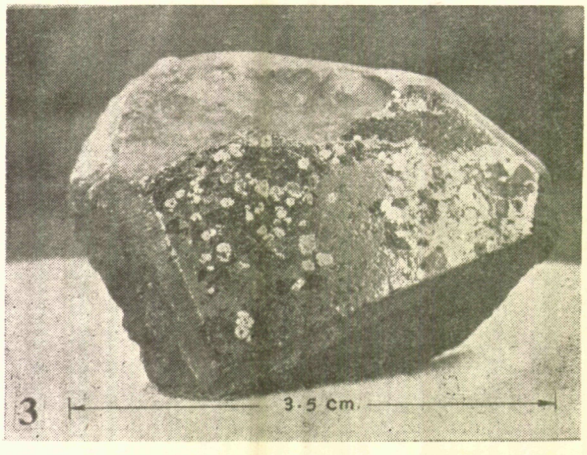


Figure 1. Rounded, oval shaped and elongated silicate fragments (dark) in pyrrhotite matrix (white). 5×.

Figure 2. Round shaped balls of quartz (light to dark grey) in chalcopyrite matrix.

Figure 3. Rounded porphyroblasts of pyrite embeded in chalcopyrite and pyrrhotite rich matrix.

rounded forms within the sulphide mass during deformation. As cited by Vokes (op. cit.), the process and the resultant fabrics can be observed to be more pronounced where the predominant iron sulphide is pyrrhotite, as it is more easily plastically deformed than pyrite. In the Khetri copper belt, where the ore is predominantly pyrrhotitic, ball texture is more pronounced. Rounded, oval shaped, elliptical or elongated silicate fragments are found in the pyrrhotite matrix (Fig. 1). Rounded and spherical balls of quartz are noted in the chalcopyrite matrix (Fig. 2).

Ball texture is occasionally observed between different sulphide minerals where highly rounded porphyroblasts of pyrite occur embedded in a matrix of chalcopyrite and/or pyrrhotite (Fig. 3) in which the porphyroblasts are completely 'milled' or 'kneaded' during deformational movements.

The ball ores represent 'an extreme phase of an essentially continuous process of deformation'. Moreover this texture represents the penetrative second phase of folding/metamorphism (Sen *et al*, 1973) and the ore is definitely premetamorphic.

References

GEIJER, P., (1971) Sulphide 'ball ores' and the pebble dykes. *Sver. Geol. Unders.* C. 662 (Arsb. 65, 8), pp. 1-29.

SEN, R., MUKHERJEE, A. D. and BANERJEE, A. K., (1973) Metamorphism and deformation of sulphides—I General Remarks. *N. Jb. Miner. Abn.*

VOKES, V. M., (1973) 'Ball texture' in sulphide ores. *Geol. Forening. Stockholm, Forhand*, v. 95, pp. 403-406.