CHAPTER I

INTRODUCTION

Gold is one of the rare noble metal elements on the earth. Common rocks contain only a few ppb of gold. However, gold has been sufficiently concentrated in certain rocks by certain geologic processes that these rocks can be mined for gold alone. What are these processes? How they operated, when they operated and where they operated? An understanding of all these aspects of gold deposits is particularly important for future exploration of this metal.

Archean greenstone belts of many shield areas throughout the world are known for many important metallic mineral deposits, particularly for their gold mineralization. Gold mineralization commonly occurs as stratiform, stratabound, disseminated and vein-type ore bodies associated with greenstone belt metavolcanics and banded iron formations. Among these, vein-type gold-quartz lodes are economically the most important followed by stratiform type deposits associated with the banded iron formation (Fripp, 1976). Despite the fact that gold is being mined in several greenstone belts of the world over, very little is
known about the genesis of this noble metal mineralization.

One of the major problems in the genesis of Archean gold deposits is the source rock for gold, which needs to be resolved. There appears to be no relationship existing between gold mineralization and the chemical nature of host rocks, unlike Ni-sulfide deposits which are more commonly associated with ultramafic rocks of komatiitic affinity, formed in Archean greenstone belts (Naldrett, 1981). Viljoen et al. (1970) considered the ultramafic komatiites of Archean greenstone belts as source rocks for gold mineralization in South Africa. Because of the close spatial relationship between komatiitic ultramafic flows and major gold deposits at Timmins, Ontario, Canada, Pyke (1975) suggested komatiitic ultramafic source for gold. However, because of very low concentrations of gold in komatiitic lavas, Anhaeusser (1976) doubted the komatiites as source for gold. Thus, the source for gold associated with Archean volcanic terrains is not clear. Recently, considerable attention has been paid by several Precambrian Ore research teams all over the world, in terms of understanding the source for gold and the geological processes responsible
for the concentration and deposition of gold in the rocks of the greenstone belts. It is believed that gold in most primary deposits was dissolved transported and deposited in its present location by hot aqueous solutions generated either by downward percolating sea water through the hot volcanics or from syn/post kinematic granitic intrusions. Because of the close association of gold with sulfide/carbonate facies of banded iron formation, which are in turn associated with greenstone belt volcanics, a genetic link in the formation of these units has been proposed (Fripp, 1976). Thus there exists a great deal of controversy in the genesis of gold deposits associated with Archean greenstone belts. A better understanding of all these processes of solution, transportation and deposition of gold in Archean greenstone belts is essential for developing any scientific exploration model for this noble metal deposits. This is particularly important, because many greenstone belts in India include banded iron formations in their stratigraphy, irrespective of their ages.

Although sporadic occurrences of gold is seen in all the schist belts of the Dharwar craton, interestingly, economic concentrations of gold is particularly
confined to the eastern-most belts (i.e., Hutti, Ramagiri and Kolar). Among these, the Kolar Schist Belt is the most important one. As a part of our major study in understanding the relation between the nature of Precambrian volcanic processes and the ore forming processes, we have chosen the Kolar Schist Belt for our studies. Among the many greenstone belts in the Dharwar craton, the Kolar Schist Belt has been extensively studied for its structure, stratigraphy and petrogenesis (Narayanaswami et al. 1960; Viswanatha and Ramakrishnan, 1981; Rajamani et al. 1981, 1985).

The Kolar Schist Belt is well known for its gold mineralization and for systematic gold mining for well over hundred years. Gold occurs here both as gold-quartz lodes and as gold-sulfide lodes associated with amphibolites and banded iron formation respectively in Kolar Gold Field area, and also as gold-sulfide lodes in association with banded iron formation near Mallappakonda. Despite systematic mining at "ancient working spots" and the geological and structural mapping by Narayanaswami et al. (1960) not much is known on the geochemistry of ore lodes to understand the nature and origin of this important gold mineralization. As a part of our major investigation, we have undertaken a detailed mineralogical and geochemical
studies on the gold mineralization of the Kolar Schist Belt to understand the nature of ore forming processes and to understand the relation/link among the various components of the Kolar Schist Belt.

Kolar gold deposits are unique in all aspects of their existence and pose several intriguing questions like why there are two types of gold deposits within a small belt? Why the sulfide lodes and quartz lodes are geographically restricted in their occurrence? Are these two types related geologically or not? What was the geologic sequence of events responsible for these deposits? What were the physico-chemical environment of ore transportation and deposition? What were the ultimate sources of the ore and gangue components? To provide data base to answer these basic questions, we studied (1) the field relations of various ore lodes and the associated host rocks; (2) mineralogy and paragenesis of ore minerals; (3) the mode of occurrence of gold in various ore lodes, and (4) the geochemistry of ores and ore minerals. Using the present data and data that are already available in published literature on various aspects of the belt, we have discussed the possible models for the origin of the gold mineralization in the Kolar Schist Belt.