1. Introduction

At the eastern flank of the West African craton are Palaeoproterozoic rocks, which were affected by 2100 Ma Eburnean thermotectonic event, referred to as the Birimian (Kitson, 1918). Early stratigraphic subdivision by Junner (1940) into Lower Birimian Series made up mainly of metasedimentary rocks and Upper Birimian Series comprising of metavolcanic rocks and greywacke was contested by neighbouring Francophone geologists as their scheme was reversed comprising of lower formation volcanique, middle formation volcano-sedimentaires and an upper formation sedimentaire (Tagini, 1971). Currently, Leube et al. (1990) consider the rock types as deposited contemporaneously and form a lateral facies. The Birimian, on the basis of isotopic age, is Middle Precambrian having been deposited between 2100 and 1900 Ma (Ashiene and Barning, 1975). Four types of granitoids that lack cross-cutting relationships are present in the Birimian. Associated with the metasedimentary rocks are basin granitoids which are foliated and were emplaced before the belt granitoids, which are mainly amphibole-rich granodiorite and found in association with the metavolcanic rocks. Localised Winneba granites are restricted to the area occupied by the metasedimentary rocks and cut by the basin granites and so considered as having Achaean precursor.

The Talkwai sedimentary rocks are regarded as younger than the Birimian as Kawere conglomerate at the base consists of reworked polymictic pebbles of various Birimian rocks. The Talkwai rocks are intruded by diabase/dolerite sills and dykes and also the Bongo granitoid which is K-rich and located at Bole-Navorongo belt. The Birimian rocks have generally been metamorphosed to lower greenschist facies but amphibolite facies may occur as contact metamorphic aureoles (John et al., 1999). Structurally, Junner (1940) identified two main deformations in the Birimian. Thus the lower Proterozoic Birimian has many similarities as the Achaean greenstone belts described by Condie (2005) and so it is loosely referred to as a greenstone belt although no komatiitic volcanic rocks occur as in the Achaean counterparts. The Birimian is rich in gold and manganese deposits in addition to bauxite and localised diamond, derived from the Achaean rocks out of which the sediments were originated. There are many occurrences of manganese deposits in almost all the six NE trending volcanic belts in Ghana, located at the contact between the metavolcanic and metasedimentary rocks and enclosed within schists, phyllites and metavolcanic rocks.

2. Sources of Mn in the Birimian

Various sources of manganese have been proposed in the Birimian. Example, Melcher (1995), on the Nangodi belt, showed that manganese was formed in relatively oxidised to more reducing environment. At Nsuta deposit, Service (1943) linked the lenticular manganese ore to contemporaneous deposited volcano-sedimentary rocks. Consequently, Mn sources have been related to volcanism (Kleinschrot et al., 1994); volcanic exhalation (Ntiamoah-Agyakwa, 1979) and hydrothermal fluids (Dzibgboi-Adjimah and Sorgbor, 1993). Continental sources were suggested by Mücke et al. (1999). Nyame and Beukes (2006) showed that minor fluid infiltration with organic matter could produce the manganese carbonate protore at Nsuta that has lighter δ13Corg and heavier δ18Owater. At Mankwadzi (Winneba-Kibi belt), Dzibgboi-Adjimah (2003) identified Fe as indigenous to sedimentation in quartzites but Mn is hydrothermal.

References


