The bacterial oxidation of ores has been recognised as contributing to extraction of metal since the discovery of *Acidithiobacillus ferrooxidans* in 1947. Although bioleaching has been studied more than 65 years, there are a number of outstanding issues that remain. For example, the bioleaching process is still slower than conventional techniques (i.e. pyro-metallurgical process), which may increase the cost. Not all ore types even those containing sulphur can be bioleached. A key success factor is the ability to control microbial growth, which is influenced by many variables: types of microorganisms, ore types, type and quantity of metal, nutrient addition, oxygen supply, pH, temperature and particle size. The bioleaching of a given ore from different sources and/or different types of ores also requires test studies to be conducted, despite the success of metal extraction by the same bacteria in other ores. Consequently, it is necessary to find an optimum condition for a particular case.

Although ore heap leaching of metal sulphides has been widely used for over a decade, there are still some production issues and some specific technical questions as follow:

- How long does it take for the microbial population to develop in the heap when the source of the organisms is the raffinate and natural development in the stacked ore?
- Would inoculation of the ore be of any benefit?
- Is aeration necessary during the entire leach period and what aeration rate is really needed?
- Why does the temperature in most secondary metal heap leach operations remain quite cool? Is this a result of slow oxidation of sulphides, the absence of pyrite oxidation, or are there other reasons?

The present investigation work was therefore planned to study some of the above aspects to develop a laboratory scale heap bioextraction process for
zinc and copper from low grade G.M.D.C. polymetallic ore. The stepwise research objectives were determined as follows;

✓ Screening of available ore materials for their feasibility for leaching in terms of metal and gangue content of the ore.

✓ Isolation and partial characterization of autotrophic iron and sulphur oxidizers from collected AMD samples

✓ Isolation, biochemical characterization and phylogenetic analysis of heterotrophic sulphur oxidizing denominators from collected AMD samples.

✓ Development of the consortium by selection and adaptation for the exploitation in heap leaching.

✓ Heap bioleaching study for base metal extractions from G.M.D.C. polymetallic ore at 3 kg (small) and 100 kg (big) scale.

✓ Big scale (100 kg) heap bioleaching study for base metal extractions from G.M.D.C. polymetallic ore.

✓ Microbial diversity study of the heap by molecular tools and its correlation with other techniques used to evaluate the microbial communities from leachate and ore samples.