CHAPTER 1

INTRODUCTION

Man and his civilisation depend on water and minerals. Interestingly, water and mineral resources are interlinked. Water is used in the extraction, processing, and shipping of minerals. As poorer grades of minerals are mined, the amount of water used in mining and industry is expected to increase significantly. Water and mineral resources have been exploited, and the time has now come - or it may have passed - for them to be better managed. There are ecologically sound ways to approach the management of these essential resources, but they have yet to be implemented. Water and mineral resource problems will be among the most important environmental problems in the future. This dissertation will only emphasise on a small aspect of water resource problems, i.e. the pollution of interstitial water by heavy metals.

The study areas chosen in the present investigation are shown in the map depicted in Figure 1.1. They are however not situated in the same topography. The sites in Mukim Klang are situated at a higher elevation i.e. about 3.2 m above sea level and the Teluk Intan site about 2.8 m above sea level. The study sites in the District of Sabak Bernam are only slightly higher than sea level, i.e. 1.2 m above sea level (RSD Engineering Sdn Bhd, 1980 and Cadence Kontrak Bina Sdn Bhd, 1980). Apart from topographic differences, the anthropogenic activities in these areas are also quite different. The sites at Mukim Klang being urban are mainly involved with industrial activities and some are

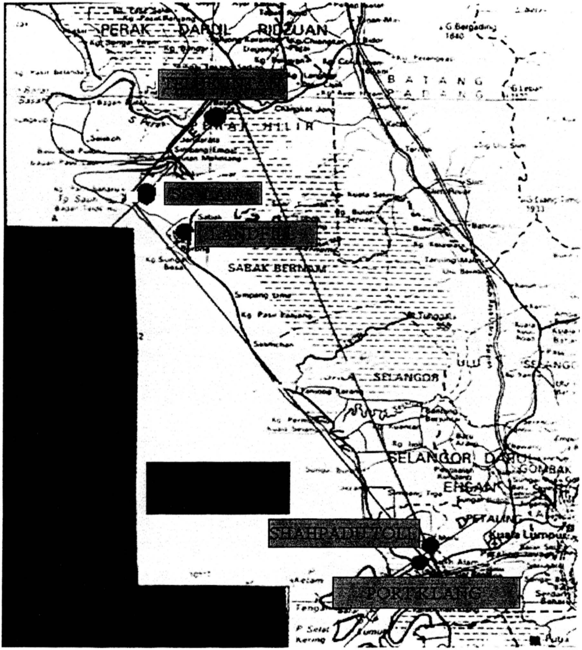

Fig. 1.1 Map depicting study sites chosen in the present investigation. Sg Lang (Site 3) , Sabak Bernam , Landfill (Site 4) , Teluk Intan (Site 5) , Shahpadu Toll (Site 2) , Port Klang (Site 1)

related to iron and steel. The district of Sabak Bernam and Teluk Intan are mainly involved with agricultural activities that include coconut, rubber and oil palm plantations. There is also a municipal landfill in Sabak Bernam and this site is also chosen for the present study. Why are these sites chosen for the present investigation of heavy metals interstitial water?

In general, human activities, whether domestic, agricultural or industrial will discharge some amount and some form of wastes. Human domestic activity wastes may be discharged through drains that will finally find themselves into rivers and seas. Agricultural products can contain chemicals that can eventually find themselves dissolved in rain water or run-off waters and finally leach into the ground. Landfill wastes and industrial wastes may undergo decay, oxidation and corrosion and allow metal ions to dissolve in water and become distributed to the surroundings through surface or sub-surface lateral movements and also vertical motion into the ground. These phenomena may lead to groundwater contamination. Pitchel et al.(1997) have shown that metals from anthropogenic sources are relatively mobile in soil. Hence, there can be no doubt that groundwater can be contaminated by heavy metals. In addressing groundwater contamination, one can also reflect soil contamination since they are very much connected. Soil contamination is also a world wide environmental problem (Ghestem and Bermond, 1998).

In the context of the current work, several bore holes have been dug and water is derived from the soil obtained by a method that have been developed and called the "squeeze by rotation" method. The soil is dug up to a maximum depth of 40 m in some areas and to a slightly lower depth in places where the soil is too difficult to bore. It is preferred to distinguish the water obtained as interstitial or pore water rather than groundwater *per se*, in accordance with Bervoets et al.(1997) and also in accordance to the method the water is derived, i.e., the water must come from the pores in between the soil particles. This interstitial water can also become a part of groundwater *per se* once it reaches an aquifer. In this work, sampling is depth related. This approach was claimed by Reimann (1997) to be a viable approach in establishing concentration of naturally occurring elements and their variations in any one area and to identify contamination.

The interstitial water obtained will be analysed for element such as calcium, cadmium, zinc, manganese, ferrum, nickel, lead, copper and the like to test whether the interstitial water is safe for any kind of human use or otherwise. Heavy metals are potentially toxic elements (Hall and Smith, 1997). The study is also carried out to learn whether there exists any relationship; at least qualitatively, on the movement of some of the above heavy metals particularly ferrum and manganese in soils containing interstitial water. The movement of these metals may also be influenced by the pH and moisture content of the soil. Some relationships among metal-metal movements have been developed by Pyeong et al,(1997). Metal extractability as a function of pH has been studied by Yousfi and Bermond (1997). They have indicated that metals can be extracted more easily in acidic medium. Hence if the soils in the present investigation are acidic, this could enable nature to hasten heavy metal entrance into the soil and dissolve in interstitial water. Also, since one of the study sites is a landfill area, it is thought that a method for the design and evaluation of a lining system be included as an exercise to estimate of the leakage ratio of the lining system based on parameters that can be obtained from the literature. Such landfill lining systems can help to prevent leachate contamination of interstitial water and eventually groundwater. The conclusion of the work will emphasise on the level of interstitial water pollution, its potential use and the possibility of purifying it for domestic use.