INTRODUCTION

Plate tectonic processes have generated considerable geological complexity in Sulawesi, the four-armed island in the centre of the Indonesian archipelago. This region shows evidence of plate convergence involving subduction of oceanic plate (Hamilton, 1979; Katili, 1978; Wakita et al., 1996), continent–continent collision (Bergman et al., 1996), arc–continent collision (Elburg et al., 2002), sediment accretion and emplacement of dismembered ophiolites (Kadarusman et al., 2004; Villeneuve et al., 2002) and exhumation of high pressure metamorphic rocks (Parkinson, 1996; Wakita, 2000).

The collision of three major plates (the Eurasian, the Indian-Australian and the Pacific) has driven formation of the Sulawesi terrane complex. The westmost parts of Sulawesi formed the eastern margin of southeast Asia (“Sundaland”) during the Mesozoic, and the rest of the island was accreted onto these, mainly in the Oligocene and Miocene (Katili, 1978; Hamilton, 1979; Parkinson et al., 1998; Charlton, 2000; Villeneuve et al., 2002). The Tertiary collision(s) have disrupted or buried much of the Mesozoic continental margin, but fragments of pre-Tertiary basement are preserved in Sulawesi, two examples being those in the Bantimala and Barru areas (Hamilton, 1979; Parkinson, 1998; Parkinson et al., 1998; Sukamto, 1982; Wakita, 2000). These two isolated blocks, about 30 km apart, have historically been referred to collectively as the Bantimala Basement Complex.

The basement complexes in these two areas have received increasing attention since the first geological mapping in Sulawesi. A wide variety of lithologies of various ages (Hamilton, 1979; Miyazaki et al., 1996; Parkinson & Katayama, 1999; Parkinson et al., 1998; Sukamto, 1975; van Leeuwen, 1981; Wakita et al., 1996; Wilson & Bosence, 1996), paleogeographic anomalies (Haile, 1978; Sasajima et al., 1980) as well as the regional structure (Berry & Grady, 1987) has been recorded. Details of their history remain uncertain (van Leeuwen, 1981), and previous studies have regarded Bantimala and Barru blocks as being exposed parts of a single larger unit, partially exhumed after small-scale eastward subduction in the Makassar Strait (Sukamto, 1975; Katili, 1978; Guntoro, 1999).
These basement complexes contain high-pressure (blueschist, eclogite) and high-temperature (amphibolite) metamorphic rocks and almost unmetamorphosed deep marine sedimentary rocks, as well as serpentinised ultramafics of ophiolitic affinity (Hamilton, 1979; Wakita et al., 1996; Parkinson et al., 1998). These basement rocks are of particular interest since they provide an insight into the geological processes that were operating at the eastern margin of Sundaland in the late Mesozoic.

However, no detailed petrological, mineralogical or geochemical data from these two blocks have been reported to date, despite the fact that they can provide important insights into the Mesozoic evolution of the Indonesian region.

This study is primarily concerned with the origin and evolution of the basement rocks in the Bantimala and Barru area, south Sulawesi, particularly the high-pressure metamorphic rocks and the ultramafic rocks. This study will present:

1. New petrographic, mineral chemical and geochemical analyses of the rocks of the Bantimala and Barru basement complexes.
2. Constraints on the origin and evolution of the basement rocks and plate tectonic history, based on the first reported major and trace element analyses of the rocks.
3. A model for the formation of the Bantimala and Barru basement complexes.

This study is based on careful geological field observation and sampling, detailed microscopic study of the texture and mineralogy of the high-pressure rocks and associated rocks as well as the chemical analysis of the rocks and their component minerals as obtained from electron probe microanalysis (EPMA). Whole-rock major elements were analysed by X-ray fluorescence analysis (XRF), and trace element analysis by laser ablation inductively-coupled plasma mass spectrometry (LA-ICP-MS).

The thesis is structured as follows. This introduction is followed by a literature review of the tectonic setting of Indonesia and regional geology of Sulawesi (Chapter 1). Chapter 2 focusses on south Sulawesi geology and then the local geology of the Bantimala and Barru blocks. Chapter 3 presents methodology, including details of the field study and analytical methods. The petrographic data and mineral chemistry of the Bantimala block are in Chapter 4 and of Barru in Chapter 5, thermobarometry and metamorphic history in Chapter 6 and whole-rock geochemistry in Chapter 7. The findings presented in Chapters 4 - 7 are used to reconstruct the tectonic evolution of the basement complexes in Chapter 8 and finally conclusions constitute the last chapter.