1.INTRODUCTION

1.1.Regional Geology of the Limpopo Complex

The Limpopo Complex of Southern Africa is an ENE-WSW trending high-grade terrain, about 700km in length with a maximum width of 250km (Van Reenen et al., 1990) (Fig. 1.1). This granulite facies terrain, situated between two Archaean granite-greenstone cratons, the Kaapvaal Craton (KVC) in the south and the Zimbabwe Craton (ZC) in the north (Van Reenen *et al.*, 1992), is subdivided into three geologically distinct terrains separated by prominent shear zones (e.g. Watkeys, 1983 and Van Reenen *et al.*, 1990): the Northern Marginal Zone (NMZ), composed of granite- greenstone material at granulite grade, is separated from the Zimbabwe Craton in the north by the southerly dipping ~2.6Ga dip-slip Northern Marginal Thrust Zone (Mkweli et al., 1995). On the southern side the NMZ is separated from the shelf-type supracrustal sequence of the Central Zone (CZ) by the ~2.0Ga southerly dipping strike-slip Triangle Shear Zone (Watkeys, 1983, Kamber et al., 1995b). The 2.0Ga strike-slip Palala Shear Zone, that dips steeply to the north, separates the CZ from the Southern Marginal Zone (SMZ) (McCourt, 1983), which is also underlain by granite-greenstone material at granulite grade (Van Reenen *et al.*, 1990; Kreissig et al., 2001). The southern terrain boundary separating the SMZ from the granite-greenstone terrain of the Kaapvaal Craton is the ~2.6Ga dip-slip Hout River Shear Zone that dips steeply northwards (Van Reenen *et al.*, 1990; Smit et al., 1992; Smit and van Reenen, 1997).

<u>The Northern Marginal Thrust Zone (NMTZ)</u> is the most important D_2 shear zone in the NMZ (Mkweli and Blenkinsop, 1996). It is characterized by strongly developed down-dip lineations plunging SSE (Ridley, 1992; Mkweli *et al.*, 1995; Rollinson and Blenkinsop, 1995). The shear zone controlled the uplift and decompression of this high-grade terrain in the Late-Archaean (Van Reenen *et al.*,1995).

The Northern Marginal Zone. Two main groups of lithologies characterize the NMZ: a dominant plutonic assemblage characterized by large volumes of charnockitic rocks, dated at 2627±7 Ma (Mkweli *et al.*, 1995), and a suite of K-rich porphyritic granites (the Razi Granite) that intrudes the NMZ-ZC boundary (Rollinson and Blenkinsop, 1995). Minor outcrops of supracrustal lithologies occur in this zone. The NMZ is subdivided into three distinct subzones (Fig. 1.2) reflecting different structural and metamorphic histories (Rollinson and Blenkinsop, 1995; Kamber *et al.,* 1995b). The southern most unit includes the dextral Triangle Shear Zone that experienced granulite facies metamorphism (750ºC-800ºC and 0.9Gpa) at 2000 Ma which almost completely erased evidence of an older 2600 Ma event (Kamber *et al.*, 1995a). The intermediate transitional zone is partially overprinted by the Proterozoic metamorphic event with an overprint of granulite to mid amphibolite facies (600ºC to 0.65Gpa) from the SSE to the NNW (Kamber *et al.,* 1995b). The northernmost unit of the NMZ experienced granulite facies metamorphism in the late-Archaean and shows little or no effect of the late Proterozoic event (Kamber and Biino, 1995).

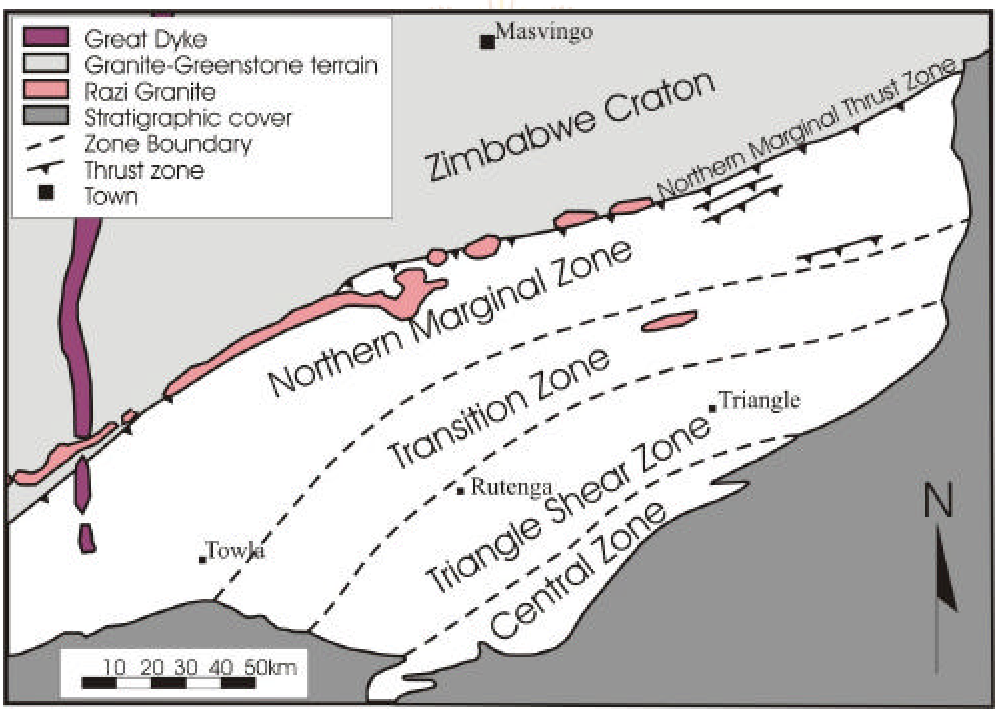

Figure 1.2: The different divisions of the Northern Marginal Zone (After Kamber et al., 1996).

The Triangle Shear Zone (Fig. 1.2) (Ridley, 1992) is an east-northeast trending belt of mylonite and ultramylonite with preserved high-grade mineral assemblages (Ridley, 1989; Kamber *et al.,* 1995). Kinematic indicators, including shear bands, are compatible with a dextral sense of movement. The lack of retrogressive textures in mylonites from the Triangle Shear Zone suggests that the deformation may have taken place under conditions close to granulite facies (Van Breemen and Hawkesworth, 1980). Kamber *et al.* (1995) calculated essentially constant pressure-temperature conditions of 8kbar and 880°C across at least 20 km of the 30-50 km wide Triangle Shear Zone, and followed the original suggestion by Van Breemen and Hawkesworth (1980) that these conditions reflect a major tectono-thermal event at 2000 Ma.

The Central Zone (CZ) (Fig. 1.3) consists of the supracrustal Beit Bridge Complex, several suites of grey and leucocratic gneisses, the Messina Layered Suite and the Bulai, Phikwe and Makowe plutons. It reflects a highly complex deformational history characterized by the presence of circular and cross folds (Roering et al., 1992b; Van Reenen *et al.*, 1999). Published isotope data from the CZ indicate a long geological history ranging from about 3300 to 2000 Ma (e.g. Holzer *et al.*, 1998; Kröner et al., 1999).

The Palala Shear Zone (Fig. 1.3) (McCourt, 1983; McCourt and Vearncombe, 1987; Schaller et al., 1999) is a 10-12 km wide belt of steeply northeast dipping ultramylonite and mylonite dominated by a sub-horizontal mineral elongation lineation trending east-northeast (McCourt and Vearncombe, 1987). Shear sense indicators related to this lineation are compatible with regional sinstral motion (McCourt and Vearncombe, 1992). Published geochronology on the Palala Shear Zone (Schaller *et al.*, 1997, 1999) reflects two granulite facies events, at 2602± 40Ma, and at 2020 ± 8 Ma (Schaller *et al.*, 1999).