INTRODUCTION

The discoveries of magnesite in mantle xenoliths (McGetchin and Besançon 1973; Rovetta and Mathez 1982; Berg 1986), as inclusions in diamond (Leung 1990; Wang et al. 1996), garnet peridotite, and websterite (Yang et al. 1993; Zhang and Liou 1994), together with experimental studies of magnesite stability (Ross and Reeder 1992; Gillet 1993; Redfern et al. 1993; Liu and Lin 1995; Zhang et al. 1998) suggest that magnesite is a major stable carbonate in the mantle. Magnesite and dolomite have been reported in ultrahigh-pressure metamorphic (UHPM) eclogites such as Dabie-Sulu eclogites in China (Zhang and Liou 1994; Liou et al. 1998; Omori et al. 1998) and the western Alps, Italy (Messiga et al. 1999). The experimental phase relations defining silicate-carbonate phase relations and thus stabilities of individual carbonates in peridotites and high-temperature eclogites (defined by Carswell 1990) are reasonably well constrained (Brey et al. 1983; Olafsson et al. 1983; Yaxley and Green 1994; Knoche et al. 1999), but less well understood for low-temperature glaucophane-bearing eclogite. In this paper, we report the field occurrence of magnesite in eclogite from Tianshan, China, and calculate its phase relations in glaucophane-bearing carbonate eclogite. These results further support the UHPM in western Tianshan, as concluded by Zhang et al. (2002).

OCCURRENCE AND MINERAL ASSEMBLAGES

Magnesite and dolomite have been identified in type III eclogites from western Tianshan, China. As described in Part I (Zhang et al. 2002), type III eclogites are banded calcite/dolomite eclogites that occur as lenticular bodies within marbles. The banded structure comprises layers of laminated calcite or dolomite, garnet, and omphacite. Their protolith may have been marly limestone. For geological setting and sample localities see Figure 1 of Zhang et al. (2002). They are characterized by more than 30% carbonate, along with garnet (15%), omphacite (20%), glaucophane (20%), zoisite (10%), and paragonite (5%), together with minor rutile and titanite. Porphyroblastic garnet (0.5–1.0 mm) has inclusions of quartz pseudomorphs after coesite (Fig. 1A). Garnet rims are replaced by glaucophane and dolomite (Fig. 1A). Primary omphacite occurs as fine prismatic inclusions within dolomite (Fig. 1A), and as medium-grained aggregates of short prismatic crystals associated with garnet replaced by secondary glaucophane (Fig. 1B). Magnesite was found only as relict, rounded to subidiomorphic inclusions (0.01–0.1 mm) within dolomite (Figs. 1A and 1B), and as rounded inclusions with thin reaction rims of dolomite within