

* ERRATA *

Corrections to Reviews in Mineralogy Volume 26 - Contact Metamorphism
Chapter 5 "Phase Equilibria and Thermobarometry of Calcareous, Ultramafic and Mafic
Rocks, and Iron Formations, pages 207-289

R. J. Tracy and B. R. Frost

Corrected Figure Captions

Figure 35. Displacement of metaperidotite phase equilibria (see Fig. 33) due to solid solution of iron in ferromagnesian minerals. Diagram was calculated using Ge0-Calc (Brown *et al.*, 1988), based on a range in olivine composition of $X_{Mg} = 0.85$ to 0.95 (Fo 85 to Fo 95) with appropriate X_{Mg} for other ferromagnesian minerals calculated using the K_D values of Trommsdorff and Evans (1974). In all cases, the lower-temperature curves are for minerals in equilibrium with Fo 85 olivine, and the higher-temperature curves for minerals in equilibrium with Fo 95 olivine.

Figure 36. 3 kbar T - X_{CO_2} diagram showing phase relations in ophicarbonates. Reactions labelled with "c" include calcite; those labelled with "m" include magnesite; those labelled with * are calcite- and magnesite-free. Reactions are numbered according to the original paper; correspondence to Table 4 is as follows (Trommsdorff and Evans number in parentheses): (0*)- 65; (1c) - 136; (1m) - 137; (3c) - 138; (6*) - 139; (7c) - 140; (8c) - 141; (9c) - 61; (10*) - 142; (13c) - 144; (14c) - 60; (16m) - 70; (17m) - 45; (23*) - 146; (24*) - 62. [Used by permission of the editors of Contributions to Mineralogy and Petrology, from Trommsdorff and Evans (1977b), Fig. 4, p. 309].

Figure 38. Reactions involving tremolite breakdown and the occurrence of plagioclase in the system CMASH in metaperidotites (see text) (after Frost, 1975). For the topologic effects of Al substitution in amphibole, see Frost (1975). Chemographic diagrams show phase relations projected from Fo onto the CaO-Al₂O₃-SiO₂ plane in the CMAS tetrahedron, and are valid for ol- and H₂O-saturated environments. X's indicate assemblages found at Icicle Creek (Frost, 1975). Dashed lines represent metastable equilibria where either ol or H₂O-rich fluid are absent.

Figure 39. Schematic P-T diagram showing how reactions subdivide P-T space into regions that correlate with the labelled facies in high-grade aluminous metaperidotites (after Klewin, 1982).

Figure 41. Generalized geologic map of the contact aureole of the Mt. Stuart batholith at Paddy-Go-Easy Pass, in the Cascades of Washington (modified from Frost, 1975). Four isograds are shown: Serpentine-out, Anthophyllite-in, Enstatite-in, and Chlorite-out. The ath-in and en-in isograds coincide in the NE corner of the map area. For a more detailed map, see Frost (1975, Figure 2, p. 275).

Figure 42. P_f - T equilibria for a metamorphosed basalt at oxygen fugacities defined by FMQ (from Spear, 1981). Starting assemblages are: square - pl+cpx+ol+ilm (or hem); circle - pl+cpx+amphibole+ilm (or hem)±opx; diamond - pl+amphibole+ilm (or hem). Resulting assemblages are indicated by the portion of the symbol filled: NW quadrant - amphibole; NE quadrant - opx; SE quadrant - cpx; SW quadrant - ol. Non-standard abbreviations: am - amphibole; cp - clinopyroxene; hm - titanohematite; qt - quartz; pb - pseudobrookite; sp - sphene. [Used by permission of the editors of American Journal of Science, from Spear (1981), Fig. 11, p. 717.]

Figure 44. A simplified reaction space, represented by edenite units per formula unit (ed) vs. tschermakite units per formula unit (tsk), which shows how hornblende composition determines the products of hornblende breakdown. The solid line near the bottom separates a region where quartz is produced (below the line) from another where quartz is consumed (above the line). Dashed contours show the calculated amount of quartz consumed per mole of hornblende. Also shown are representative amphibole compositions in rocks from Morton Pass, Wyoming, and elsewhere (B. R. Frost and C. D. Frost, unpub. data).

Figure 45. $\log fO_2$ vs. T diagram for the conditions of formation of pyroxene hornfels from Morton Pass (Russ Nabelek, 1989; B. R. Frost and C. D. Frost, unpub. data), from Skaergaard (Manning, 1989), and from Skye (Ferry *et al.* 1987). $\log fO_2$ is defined as deviation of fO_2 from FMQ (in log units). The approximate temperature boundary between two-pyroxene and pyroxene-olivine hornfels is shown at the top of the diagram.

Figure 47. Geologic sketch map of the contact aureole in southern Skye (modified after Ferry *et al.*, 1987). N-S and E-W UK grid references are indicated. Smectite and amphibole isograds are indicated. The olivine isograd in the lower right-center of the map (tick-marks on the high-grade side) is shown in detail in the blown-up inset map at the lower right.

Figure 48. Map of “isograds” in the contact aureole in the Karmutsen basalts, Mt. Menzies traverse, Vancouver Island. In order, going north: boundary between zeolite and prehnite-pumpellyite facies (after Cho *et al.*, 1986); boundary between metabasalts with Wrangellian pole and those whose magnetic pole has been reset to a Jurassic orientation by contact metamorphism, marked “remagnetized isograd” (after Shive *et al.*, 1991); boundary between prehnite-pumpellyite and greenschist facies, marked “actinolite-in” (after Chou and Liou, 1987); boundary between greenschist and hornblende hornfels facies, marked “hornblende-in” (after Kuniyoshi and Liou, 1976); pyroxene hornfels facies inclusions in the granodiorite indicated by “opx-in”.

Figure 50. (a) Whole rock Na_2O content (in wt%) for metabasite at Morton Pass as a function of distance in meters from the same marble contact as in Figure 49. (b) Na+K (per formula unit) in hornblende in metabasites at Morton Pass as a function of distance in meters from the same marble contact. Note how the Na+K content of hornblende is strongly correlated with whole-rock Na_2O rather than with hornblende abundance (compare with Fig. 49).

Figure 53. Schematic isobaric T- XCO_2 diagram for mixed-volatile reactions in the system FeO- Fe_2O_3 - SiO_2 - H_2O - CO_2 , with all reactions assumed to be saturated with either magnetite or hematite, or both. Hypothetical contours for fO_2 are shown as fine lines representing decreasing fO_2 with increasing temperature (modified from Frost, 1979b). Inset shows details of the low-temperature, low- fO_2 portion of the diagram. Arrows indicate possible T- XCO_2 paths during prograde metamorphism, and the B, C and D labelling refers to observed assemblage sequences (for details, see Frost, 1979b).

Figure 54. Schematic isobaric T- XCO_2 diagram for the Al_2O_3 -free iron formation multisystem CaO- Fe^*O - SiO_2 - H_2O - CO_2 . Topology was derived for the case where $Fe/(Fe+Mg+Mn)$ of the Fe^*O component ($FeO+MgO+MnO$) in ferromagnesian phases was arbitrarily defined at 0.7 to conform to typical iron formation mineral compositions. Quartz-absent reactions involving greenalite and minnesotaite at low XCO_2 have not been plotted, but all other quartz-absent reactions have (modified after Haase, 1982). Correspondence of Haase reaction numbers to those in Table 7 (Haase numbers in parentheses): (34) - 163; (24) - 162; (51) - 178; (49) - 176; (23) - 171; (50) - 177; (55) - 182; (5) - 167; (8) - 169; (6) - 168;

(40) - 159; (4) - 166; (3) - 165; (2) - 161; (1) - 164; (41) - 174; (42) - 175; (52) - 179; (53) - 180; (54) - 181; (22) - 170; (35) - 172; (36) - 173.

Figure 55. Schematic isobaric T- log fO₂ (relative to FMQ) diagram showing the stability fields of various ferromagnesian silicates and oxides in iron formations. The T-fO₂ trajectory of magnetite- and quartz-bearing iron-formations is shown by the heavy line; assemblages with both quartz and magnetite are restricted to this line.

Figure 56. Chemographic projections from magnetite (and hematite for the most magnesian samples) showing the variation in Mg/(Fe+Mg) observed in orthopyroxene and olivine in several high-temperature metamorphosed iron formations. A, B, C = iron formations from regional metamorphic terranes; D, E = iron formations from contact aureoles. The wide range in composition seen among the examples indicates that the oxygen fugacity of the rocks was internally controlled (see text for explanation) (modified after Frost, 1976).

Figure 57. Generalized geologic map of the Lake Superior region showing the locations of detailed studies in iron formations in the Duluth complex contact aureole: the Gunflint Iron Formation (Figure 57), and the Biwabik Iron Formation (Figure 58) (modified after Simmons *et al.*, 1974).

Figure 58. Detailed geologic maps of three areas in the Gunflint Iron Formation (see Fig. 57), showing metamorphic zonation adjacent to the Duluth Complex (modified after Floran and Papike, 1978).

Figure 59. Detailed geologic map showing metamorphic zonation in the Biwabik Iron Formation adjacent to the Duluth Complex (see Fig. 57) (modified after French, 1968).

NOTE: Reversed Figures

Please note that Figures 10 and 11 (p. 219-220) have been reversed. The **correct** 500-bar diagram is shown as Figure 11 (incorrectly labeled as 1000 bars), and the **correct** 1000-bar diagram as Figure 10 (incorrectly labeled as 500 bars).