The volume-pressure trajectories inferred from the Birch equation of state are shown in fig. 5 for olivines and the olivine-transformed spinels in the Mg_2SiO_4–Fe_2SiO_4 series. The equations of state of olivines in the forsterite-fayalite series have been presented earlier [3], and they are merely reproduced here to compare them with those of the olivine-transformed spinels. The points entered in fig. 5 are isothermal compression data of a peridot-olivine, due to Bridgman [29], and of a fayalite-olivine due to recent work of Takahashi [30] *. The shock-compression data of McQueen et al. [31] for natural dunites are also compared with the volume-pressure trajectories for olivine. For the olivine-transformed spinels in the $(Mg_xFe_{1-x})_2SiO_4$ system, the only compression data, due to Mao et al. [12], are compared with the volume-pressure trajectories derived from eq. (5). It is apparent from fig. 5 that, although the present comparison is made for a pressure range of about 15% of the bulk modulus, there is a strong evidence of agreement between the experimental compression data and the present equations of state of the olivine-transformed spinels. This agreement in turn may serve as supporting evidence for the idea presented in this communication.

In addition, there is an important observation to be made from fig. 5. Shown here are the effects of iron/magnesium ratios on the compression curves of olivines and the olivine-transformed spinels in the $(Mg_xFe_{1-x})_2SiO_4$ system. Effects of an iron substitution for magnesium in these crystal lattices on the compression curve are such that the Fe_2SiO_4–spinel is less compressible than the β–Mg_2SiO_4 (spinel) at all pressures, whereas in the olivine structure we have seen [3] that forsterite is less compressible than fayalite. It may be of interest to note that, if the compression trajectories for forsterite and fayalite are extended to pressures above their olivine-spinel phase transformation pressures, these two compression trajectories cross over at a pressure of about 180 (±20) kb (corresponding to a volume ratio of $(V/V_0) = 0.9$). Above this pressure, fayalite is less compressible than forsterite; this extended observation is consistent with the compression curves of the olivine-transformed spinels presented in this paper.

* It may be noted that Takahashi found $K = 1.35$ (±0.15) Mb by a curve-fitting procedure using the Murnaghan equation of state with the assumption that $(\partial K/\partial p) = 4.5$ for fayalite. As is shown in ref. [3], the $(\partial K/\partial p)$ measured on fayalite samples is 5.97 (±0.32); using this value of $(\partial K/\partial p)$ in the Murnaghan and Birch equations of state results in a K value of 1.2 (±0.08) Mb. This new value of the isothermal bulk modulus K is in good agreement with 1.211 (±0.024) Mb reported in ref. [10].

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