TOPOLOGY OF A SECTION OF T-P-PHASE DIAGRAM $CaMgSi_2O_6$-$Mg_2Si_2O_6$, IN CONNECTION WITH A STABILITY IRON-FREE PIGEONITE

Surkov N.V. (IGM SB RAS)
diagrams@uiggm.nsc.ru

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For the first time, as the stability phase iron-free pigeonite clinopyroxene has been fixed by I.Kushiro [1, 2]. In earlier works study of the join $CaMgSi_2O_6$-$Mg_2Si_2O_6$ [3, 4, 5, 6] in the field of stability of pigeonite clinopyroxene difficulties of interpretation results of experiments and emersion "abnormal clinopyroxene" [5] which sometimes interpreted as clinoenstatite [3] were noted. That the iron-free pigeonite is an stability phase has been proved by exploration of morphology of its crystals [7]. The stability field iron-free pigeonite is investigated to 2.0 GPa [1] by method of a monovariant reactions. However, at exploration of join $CaMgSi_2O_6$-$Mg_2Si_2O_6$ at pressure 3.0 GPa [8, 9, 10] iron-free pigeonite has not been diagnosed and the supposition about its instability has been put forward. In this connection we did make investigation on stability check iron-free pigeonite in join $CaMgSi_2O_6$-$Mg_2Si_2O_6$ at pressure 3.0 GPa and temperature 1600°C.

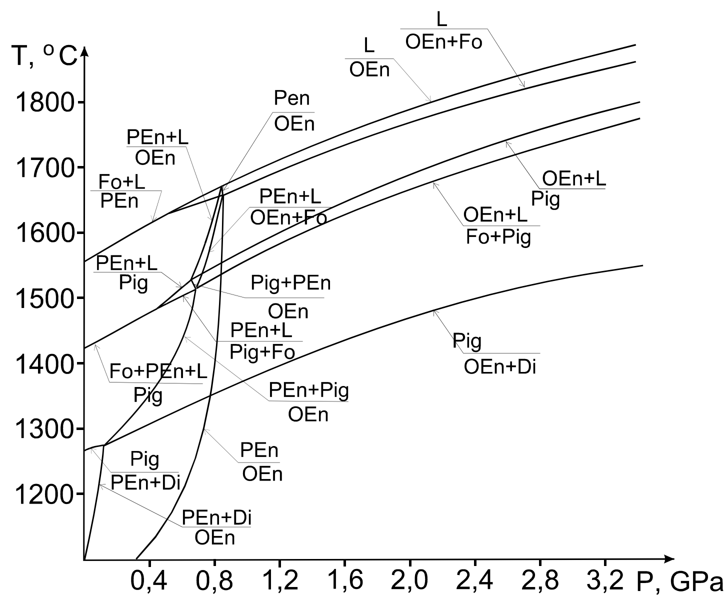

Fig.1. A stability field iron-free pigeonite clinopyroxene. The topologic variant when the reaction PEn+Pig=OEn have a sharp slope

Starting materials consisted from monomineral pigeonite, associations of solid solutions pigeonite and diopside (Pig+Di), a mechanical mixture stoichiometric protoenstatite and diopside. On the X-rays diffractograms in all cases reflection (231), characteristic only for pigeonite is detected. The results of experiments show, that iron-free pigeonite is the stable phase existing at T=1600 ^{O}C and P=3.0 GPa. Under these conditions it is form of mixtures protoenstatite and diopside and conserved further. Composition of pigeonite, co-existing with ortoenstatite at P=3.0 GPa, much more calcic, than at low pressures, that confirms I.Kushiro's data [1] about displacement compositions iron-free pigeonite clinopyroxene in calcic area at high pressure.

The reactions restricting a field of a stability iron-free pigeonite, it is may be conclusion from a known experimental material. Topological analysis of these reactions represents special interest a bright example when all phases have variable compositions, the part of reactions is in pseudo-binary system, and another - in a ternary system.

As the lower boundary line of stability iron-free pigeonite at atmospheric pressure is reaction Pig=PEn+Di (T=1260^{O}C) [11], at higher pressures - reaction Pig=OEn+Di, the position of it is investigated by a method of a monovariant reaction to 2.0 GPa [1, 12].

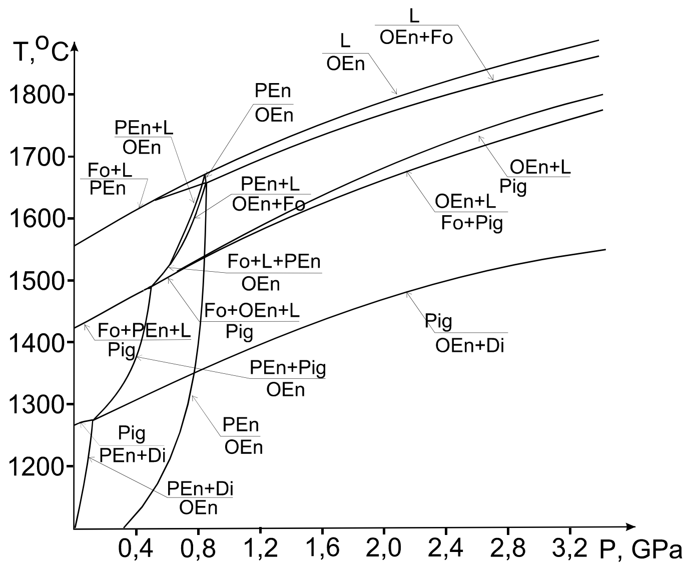

Fig.2. A stability field iron-free pigeonite clinopyroxene. The topologic variant when the reaction PEn+Pig=OEn have a more slight slope

At pressure 3.0 GPa the position of this reaction can be defined from data of B. Devis and F. Boyd [6]. Considering the materials about stability iron-free pigeonite clinopyroxene at 3.0 GPa, it is possible to refer S-shaped branch at the diopside part of solvus as a presence not diagnosed pigeonite.

The topologic variant when the reaction PEn+Pig=OEn have a sharp slope. The high temperature range of stability iron-free pigeonite is fusion reaction as: at atmospheric pressure - reaction Pig=Fo+PEn+L [7], at 2.0 GPa - the reaction Pig=OEn+L. The position of the second reaction at 3.0 GPa can be defined according to data B. Devis and F.Boy [6]. The temperature of this reaction at pressure 3.0 GPa is near 1750^{O}C.

At intersection of reaction Pig=Di+PEn and reaction Pig=OEn+Di in the region of low pressures there is a nonvariant point (Pig; OEn; Di; PEn). The position of this point is defined from a declination of reaction OEn=PEn+Di, which at atmospheric pressure is at temperature 1100 ^{O}C [3]. According data to R. Warner [12] this reaction has the abrupt positive declination and the specified nonvariant point has places at pressure 0.15-0.2 GPa and temperature 1270-1280^{O}C. The position of the fourth reaction OEn=PEn+Pig which is getting out this point, is not investigated and there are two variants. The first variant (fig. 1) is possible, if this reaction is cut with reaction Pig=OEn+L. In this case reaction Fo+L+PEn=Pig is possible at pressure not above 0.5 GPa, where is place singular point. At this pressure, there is an incongruent melting of the protoenstatite is changed on the congruent. This singular point towards high pressure is got out by reaction Pig=PEn+L and Pig+Fo=PEn+L. Both reactions are cut with reaction OEn=PEn+Pig, forming two nonvariant points (Pig;OEn;PEn;Fo;L) and (Pig;OEn;PEn;L) after this is a change of associations pigeonite with protoenstatite on a association pigeonite with ortoenstatite. For the point (Pig;OEn;PEn;Fo;L), the reaction PEn+Pig=OEn is singular as the composition of phases are disposition in binary join $CaMgSi_2O_6$-$Mg_2Si_2O_6$.

The second variant is in case have a more slight slope of reaction OEn=PEn+Pig when it is cut with reaction Fo+L+PEn=Pig, and forming a singular point (Fo;L;PEn;Pig;OEn). In this case, at pressures higher, than what pressures at this singular point, but not above 0.5 GPa, the singular point on reaction Fo+L+OEn=Pig take place, at this point the two reactions get out: Pig=OEn+L - peritectic type and Pig+Fo=OEn+L - eutectic type. On reaction Fo+L+PEn=OEn take place the singular point, at this point the peritectic reaction OEn=PEn+L and eutectic OEn+Fo=PEn+L is gets out.

Thus, iron-free pigeonite is a high-temperature phase, it is stability from atmospheric pressure up to P=3.0 GPa and above. The field of its stability represents a narrow area breadth about 200^{O}C, which with increasing pressure is a little dislodged towards high temperatures. The field of compositions of solid solutions iron-free pigeonite with increasing of pressure and, accordingly, temperatures is displaced aside more calcic compositions.

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