fluid pressure, then the total pressure
he gas species, i. e.:

$$-P_{CO}+P_{H_2}+P_{O_2}$$

$$\frac{H_4}{H_4}+\frac{f_{H_2}}{\gamma_{H_2}}+\frac{f_{O_2}}{\gamma_{O_2}} \qquad (7)$$

ent for species i at 700° K and a total
gacity coefficients of all species except
y coefficients of H_2O are interpolated
vay and Davis (1969). By making the
vo equations can be obtained from

$$10^{-3}(P-1)-\log f_{O_2}, \qquad (8)$$

$$+\frac{C\text{-}P}{A}=0$$

$$, \quad C=K_3 f_{O_2}+K_4 f_{O_2}^{-\frac{1}{2}}+f_{O_2}. \qquad (9)$$

to be solved graphically for the two
P.

ite-graphite in adjacent pelitic rocks
ne range 10^{-35} to 10^{-26}. In the absence
elitic-carbonate assemblage we have
able and Fig. 1).
artial pressures) obtained with this
ue of f_{O_2} chosen. This is illustrated in
id pressure) is plotted against f_{O_2}. As
sen value of 10^{-26} results in a variation
nately 1,000 bars. If, for example, the
f 10^{-26} the calculated fluid pressure
of 6,000 bars. A value of more than
ressure of 3—6 kb consistent with the
ner grade rocks.

pressure of gas species in equilibrium with
mblage at 700° K and $f_{O_2}=10^{-26}$

e

ars

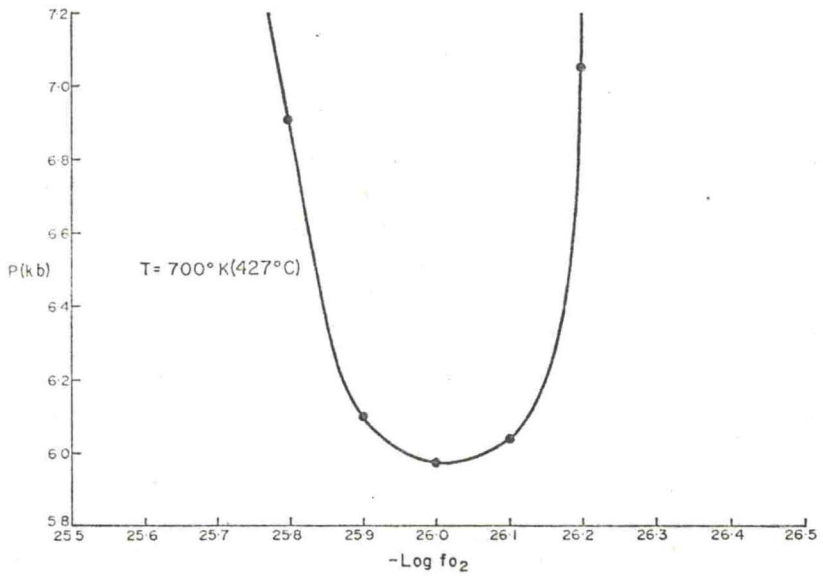

Fig. 1. Plot of calculated total pressure (= fluid pressure) versus oxygen fugacity at 700° K. Dots represent graphical solutions of Eqs. (8) and (9); see text. The minimum is not precisely determined

From the above calculations, the estimated H:O ratio in the fluid phase is 0.6:1. Thus the presence of graphite need not indicate a high H:O ratio in the fluid (Miyashiro, 1964), if CO_2 pressure is high. Conversely, a low H:O ratio in a fluid which has equilibrated with graphite need not indicate a high f_{O_2}.

Even if the above calculations are only approximate, the usefulness of calcite-quartz-plagioclase-paragonite-graphite assemblages in the estimation of fluid pressures is readily apparent. This assemblage and the analogous K-rich assemblage, muscovite-calcite-quartz-anorthite-orthoclase (Hewitt and Orville, 1966), merit further experimental investigation.

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References

Burnham, C. W., Holloway, J. R., Davis, N. F.: Thermodynamic properties of water at 1,000° C and 10,000 bars. Geol. Soc. Am., Spec. Papers **132**, 1—96 (1969).

Chatterjee, N. D.: Synthese und obere Stabilität des Paragonits. DMG Tagg., Köln, Ref., 13 (1968).

Evans, B. W.: Application of a reaction rate method to the breakdown equilibria of muscovite plus quartz. Am. J. Sci. **262**, 647—667 (1965).

French, B. M.: Some geologic implications of equilibrium between graphite and a C-H-O gas at high temperatures and pressures. Rev. Geophys. **4**, 223—253 (1966).

Goldsmith, J. R., Newton, R. C.: *P-T-X* relations in the system $CaCO_3$-$MgCO_3$ at high temperatures and pressures. Am. J. Sci. (Schairer vol.) **267-A**, 160—190 (1969).