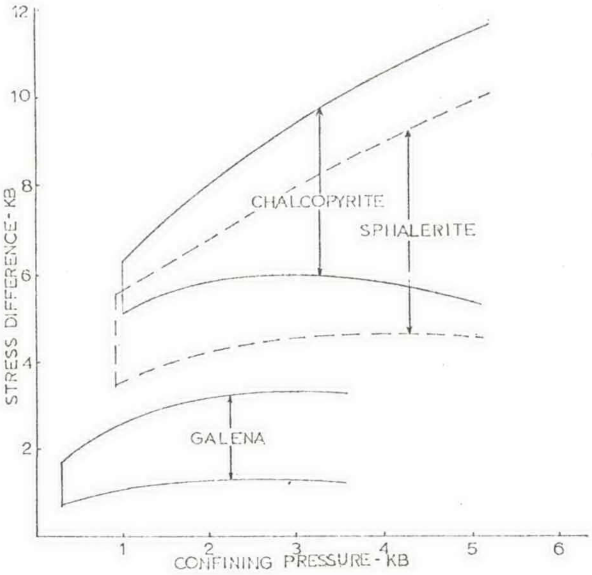

FIG. 1. Range of plastic flow for galena, sphalerite and chalcopyrite as determined by triaxial deformation experiments at laboratory temperature and at strain rates between 0.3×10^{-3} sec^{-1} and 0.3×10^{-5} sec^{-1}. Flow occurs only to the right of the vertical line connecting two curves for each of the three minerals. The lower curve gives the stress difference at which pervasive plastic flow commences. The upper curve gives the maximum stress difference sustained before rupture. Data from Siemes (1967), Saynisch (1967) and Lang (1968).

obtained by applying this correction. Thus at the depth marked by the line n d g i in Figure 2, n d represents the confining pressure and d i the approximate stress difference required to initiate plastic flow.

According to Siemes' data on galena, increase in stress difference at strain rates above 0.3×10^{-5} sec^{-1} would eventually produce rupture. At confining pressures higher than 300 bars a substantial amount of plastic flow would occur before rupture, the amount increasing with increase in confining pressure (see Fig. 1).

The line at 4.5 km depth in Figure 2 marks the level at which the confining pressure is approximately 1 kb and, therefore, the level below which sphalerite and chalcopyrite will flow plastically at 25° C (see Fig. 1). It appears probable that, because the temperature at this depth is 86° C or possibly higher, plastic flow may start at a shallower depth, but there is, at present, no precise information on this.

According to Saynisch, (1967) and Lang, (1968) the stress difference necessary to initiate plastic flow at 1 kb confining pressure and 25° C is around 3,500 bars for sphalerite and 5,000 bars for chalcopyrite. The higher temperature should also reduce these requirements.

All three sulfides would develop textures with dimensional and optical preferred orientation of grains as a result of plastic flow in the temperature range of Figure 2.

Figure 3 shows relations similar to those in Figure 2, but with a steeper temperature gradient, such as might result from batholithic intrusion. Data for galena are as before. Galena at a depth of 1.25 km (point d) should flow at a stress difference of less than 750 bars because the temperature is 100° C, under the conditions assumed. At 4/10 of the applied pressure for flow in the mullite tube experiments, it should start at around 560 bars stress difference (de). The relations at greater depth would be a vertically foreshortened version of those shown in Figure 2.

Points i, j and k in Figure 3 represent applied pressures and temperatures at which one might expect intrusion of chalcopyrite to start in mullite tube experiments similar to those conducted by Krishnamurthy (1967). Points a, b and c represent P-T conditions for recrystallization of chalcopyrite, as observed by him. Plastic flow into cracks should

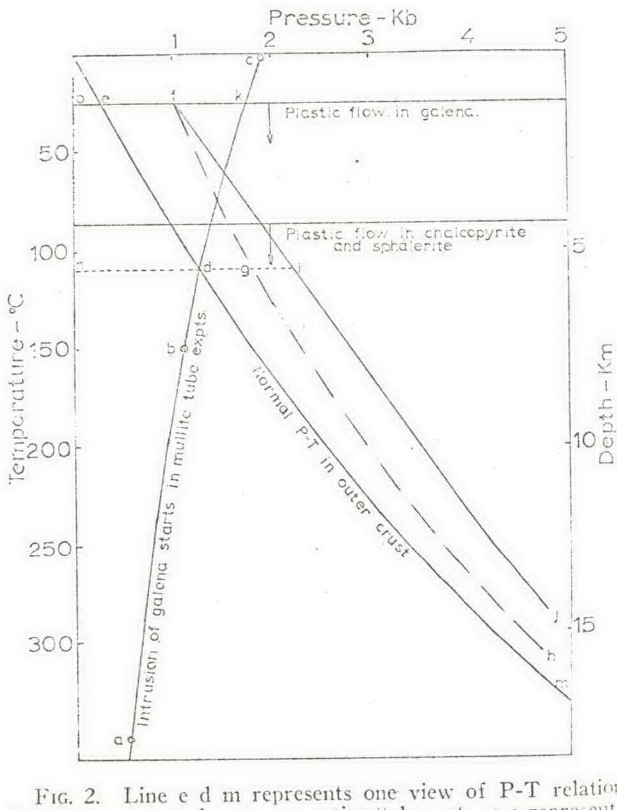

FIG. 2. Line e d m represents one view of P-T relation in the outer part of average continental crust. o e represents the confining pressure (300 bars) and e f the stress difference at 1.25 km depth, where galena should start to flow at 25° C. Line a b c marks the initiation of intrusion as deduced from the mullite tube experiments (by projection of curves in Fig. 8, Gill, 1969). The horizontal distance from e d m to f i j gives the stress difference required to produce flow at greater depths. The significance of line f g h is explained in the text. Data from Davies (1965), Siemes (1967), Saynisch (1967), Lang (1968).