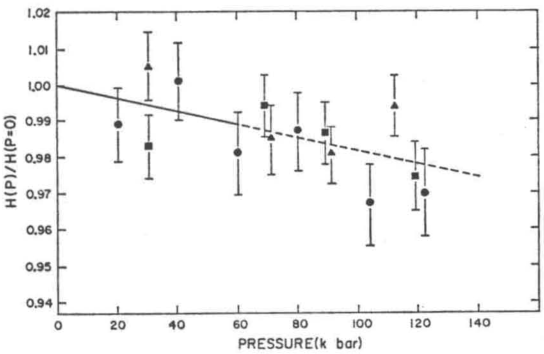

FIG. 17. Magnetic field *versus* pressure—iron.

Drickamer *et al.* (1965) and in nickel by Raimondi and Jura (1967). Zero field n.m.r. measurements in cobalt as a function of pressure have been reported by Jones and Kaminov (1960), Samara and Anderson (1963) and by Anderson (1965). In Fig. 18 are shown the smoothed values for iron in cobalt and nickel, compared with the data for pure iron discussed above. In both nickel and cobalt there is a distinct increase in magnetic field with pressure in the low pressure region, in distinct contrast to iron. In nickel there is a maximum of about 5–10 kb and in cobalt about 40–60 kb, and at higher pressures the field decreases as in iron.

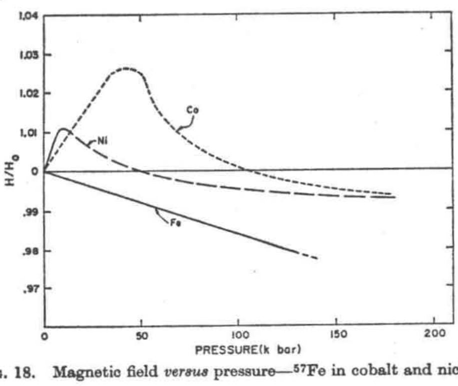

FIG. 18. Magnetic field *versus* pressure—^{57}Fe in cobalt and nickel.

Magnetism in metals and alloys is a very complex phenomenon, especially from the atomic viewpoint. There are a number of theories and no general agreement about many basic points, for example the degree to which the magnetic electrons are bound or itinerate. The theory has not advanced to the point where there is any really acceptable explanation of these pressure effects.

Cobalt oxide (CoO) at room temperature and atmospheric pressure is a cubic paramagnetic crystal with the sodium chloride (f.c.c.) structure. At 291°K it becomes antiferromagnetic, the transition being accompanied by a slight tetragonal distortion. The magnetic field has been measured as a function of temperature by Wertheim (1961) and Bearden *et al.* (1964); their results are represented on the left-hand side of Fig. 19. As one increases the pressure beyond 20 kb at 298°K, a magnetic field appears and increases with increasing pressure, as is shown on the right hand side of Fig. 19 from Coston *et al.* (1966).

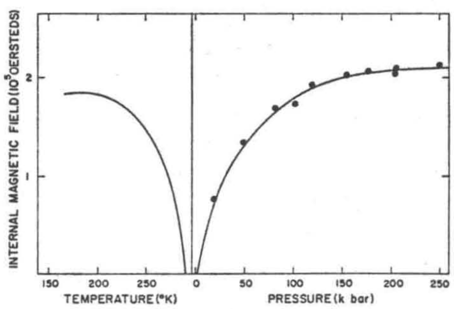

FIG. 19. Magnetic field *versus* temperature and pressure—cobalt oxide.

Since antiferromagnetism in materials like CoO is described in terms of superexchange, which depends strongly on overlap of wave functions of adjacent ions, the study of the field as a function of interatomic distance at constant temperature should be a very fruitful field of investigation.

It has been emphasized throughout this section that the initiation of ferro- or antiferromagnetism in a solid is heralded by the appearance of a six line spectrum. The observation of the appearance and disappearance of this six line spectrum as a function of pressure at constant temperature, or as a function of temperature at constant pressure, makes a very useful way of determining Curie or Néel temperatures as a function of pressure.