The above observations of dislocation generation under pressure are in keeping with the conditions calculated earlier (see table 2). The computed value of the maximum shear stress generated at the bubble–matrix interface at 25 kilobars is $G/27$, which is larger than the estimated critical stress for the nucleation of dislocations in copper. Moreover, the facts that the smaller bubbles (60 Å in diameter) appear insensitive to pressurization and the minimum size of the bubbles required for dislocation generation is about 500 Å are in keeping with the arguments presented earlier as to the influence of size. It must be noted that the critical pressure required to form these new dislocations was not determined experimentally, since pressurization was carried out at 25 kilobars only—a pressure selected because the value of the maximum shear stress calculated for this pressure approaches the nucleation stress for dislocations. However, although additional experiments at lower pressures would be needed to distinguish unequivocally between the operation of nucleation or multiplication mechanisms for the development of the pressure-induced dislocations, the latter mechanism is considered unlikely in view of the fact that dislocations associated with the bubbles were observed only rarely prior to pressurization.

While the present results appear to be first direct observations of dislocations induced around gas bubbles in a metal matrix by the application of external hydrostatic pressure, indirect experimental evidence for this type of localized plastic deformation has been reported by Miles and Gibbs (1964) who noted permanent changes in the amplitude-dependent internal friction of air-melted polycrystalline aluminium after pressurization to 6 kilobars. The changes could be eliminated by annealing and did not occur in zone-refined aluminium. However, after re-melting in hydrogen the effect could be induced in the latter material also. It was deduced from these observations that the observed irreversible effects were due to the relaxation (Snoeck damping) of dislocations which had been formed at hydrogen-filled internal cavities when the specimens were subjected to high external pressure—i.e. an hypothesis in keeping with the experimental observations made here for copper. Additional evidence for pressure-induced plastic deformation at internal cavities was reported recently by Norris (1964) for lead iodide crystals (containing bubbles filled with iodine vapour) pressurized to 26 kilobars. Limited electron microscopy observations showed changes in contrast following pressurization which were interpreted as due to deformation of the gas bubbles and the formation of pressure-induced dislocations.

Direct observations of rows of prismatic dislocation loops in magnesium analogous to those developed here in copper on external pressurization have been reported by Lally and Partridge (1966) for the inverse case of internal pressurization of hydrogen-filled cavities. The loops were observed in experiments at atmospheric pressure in which magnesium was heated and quenched in such a manner as to absorb hydrogen and then precipitate it in the form of small bubbles of high internal pressure.