

cummingtonite in the gold-bearing schists (Table 5, Study IV, V).⁷ Studies II and V show no evidence of asbestos-related diseases appearing in the study groups.

Mortality comparisons, trades vs. mines. The cancer mortality pattern for those in the asbestos trades and mining occupations is graphically presented in Figure 8, where lung cancer mortality is plotted with respect to mortality due to mesothelioma. The studies of the

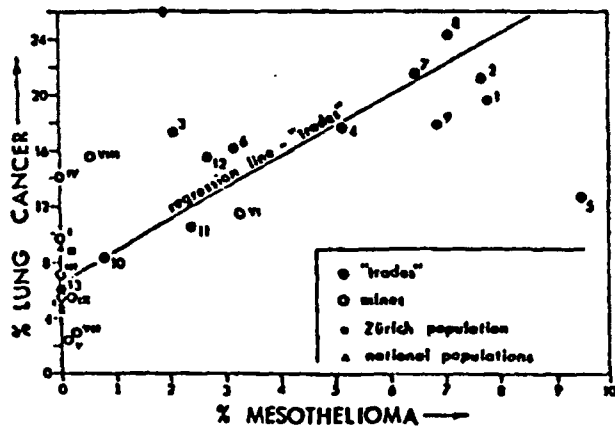


Figure 8. Graphical comparison of the proportional mortality due to lung cancer and mesothelioma for the asbestos trades workers ("trades," Table 4, Studies 1-13), the asbestos miners and millers ("mines," Table 5, Studies I-IX), the male population of the Zurich area of Switzerland, and the male populations of five nations (Table 6). Regression analysis of the mortality of the asbestos trades workers (Studies 1-4, 6-13) shows a positive correlation between the two diseases; 78 percent of the variance (r^2) of lung cancer is accounted for by mesothelioma. The regression line is of the form $y(\text{mesothelioma}) = -2.94 + 0.446x$ (lung cancer). The intercept at $y = 0$ is 6.6 percent lung cancer, a reasonable estimate of mortality for this disease if the asbestos trades workers had never worked with asbestos but had retained their smoking habits.

⁷ Study V (McDonald *et al.*, 1978) discredits Study IV (Gillam *et al.*, 1976). Study IV was accomplished on a sub-cohort of the Study V cohort. The latter study is much more complete; statistically it is based on 631 deaths, whereas Study IV is based on 71 deaths. In addition, Study IV presents an implausible mortality pattern: (1) No deaths due to silicosis, tuberculosis, or silico-tuberculosis were reported, despite the fact that the mining company has been coping with a quartz dust problem for a century, and (2) a 14.1 percent respiratory cancer mortality (incorrectly included as respiratory cancer were a sinus and a mediastinal carcinoma) was attributed to "cummingtonite asbestos," yet no mortality due to asbestosis was reported. The cummingtonite found in the quartz-cummingtonite schist host rock is not asbestos, but rather garden-variety, rock-forming amphibole.

asbestos trades workers (Table 4; Fig. 8, solid circles) show a very significant excess of mortality due to mesothelioma relative to that found in the miners (Table 5, Fig. 8, open circles) -- with one exception, the crocidolite miners of Western Australia (Study VI). For the asbestos trades workers a disease correlation is evident. Neglecting Study 5 (Table 4, Fig. 8), which is somewhat anomalous, regression analysis of the twelve trades data points (Studies 1-4, 6-13, Table 4, Fig. 8) shows a positive correlation between lung cancer and mesothelioma mortality; 78 percent of the variance (r^2) of lung cancer is accounted for by mesothelioma. Part of the remaining variance (22%) can be accounted for by inter-cohort differences in prevalence of cigarette smoking. This is because the smoking habits of asbestos workers seem to greatly influence the lung cancer incidence but not mesothelioma incidence.

In regard to high mesothelioma mortality, it is important to note the health studies of two groups of specialized factory workers who, during World War II, were employed at the task of placing crocidolite filter pads into gas mask canisters. One group working in Canada, composed of 109 men and 90 women, suffered 12.5 and 16.1 percent lung cancer and mesothelioma mortality, respectively (McDonald and McDonald, 1978). A second group of 1600 people, mostly women, were employed at this same task at a factory in Nottingham, England. Jones *et al.* (1976) reported that 26 mesothelioma deaths have occurred in this group; 25 were women. A large number of workers in these two groups were exposed to asbestos only during this brief World War II work period. The high proportion of women with their more moderate smoking habits in the gas mask worker cohorts would suggest that the ratio of mesothelioma to lung cancer (1.3 for the Canadian group) would be higher than that observed in the more typical "trades" cohorts (Table 4), where the ratio averages 0.44 (Fig. 8).

With the exception of the crocidolite miners (Study VI), the mortality patterns of the hardrock miners (Studies II, V), the tunnel workers (Study III), the asbestos miners (Studies I, VII-IX), and the chrysotile factory workers (Study 13) is quite different from that of the "trades" (Studies 1-12). The most apparent difference between the "trades" cohorts and these miners, tunnel workers, and chrysotile factory workers is the relative incidence of mesothelioma. The latter groups,