



FIGURE 3. Section of Pleura of a 61-Year-Old Man Who Had Been an Asbestos-Sheet Sticker for 22 Years (Hematoxylin and Eosin Stain, Original Magnification X600).

Seven years earlier asbestosis was recognized at our laboratory. He died three months after the onset of dyspnea, weight loss, chest pain and recurrent serosanguineous pleural effusion.<sup>22</sup> At the bottom there is a nest of asbestos bodies within a mesothelioma. In the upper right area there are several smaller bodies and fine crystals with early beading.

The chrysotile imbedded by heat in the plastic of these linings becomes anhydrous forsterite. Animal experiments have now shown that forsterite indeed can produce ferruginous bodies but that, unlike asbestos, it is nonfibrogenic.<sup>20</sup>

Sputum of asbestos workers frequently contains asbestos bodies, the frequency increasing with time of exposure (22 per cent under one year and 38 per cent over five years) and increasing with higher dust concentration.<sup>21</sup> However, asbestos bodies in sputum are not necessarily indicative of asbestosis. They have also been found in feces, presumably from swallowed sputum, and in the spleen, tonsils and lymph nodes of exposed persons. Neoplasms, particularly bronchogenic carcinoma and pleural and peritoneal mesothelioma, may contain asbestos bodies within and around them (Fig. 2 and 3).

#### EXPERIMENTAL PRODUCTION

Asbestos bodies can be produced in animals without necessarily causing fibrosis or tumor. Indeed, they have been found after only seven days of exposure.<sup>23</sup> Some animals produce them readily, most notably guinea pigs. They respond by granuloma

formation that may provide the ideal environment for coating. Rats do not form bodies, perhaps because asbestos dust causes early fibrosis.<sup>24</sup> Only a tiny fraction, probably less than 1 per cent of all the fibers in the lung, become coated (Fig. 4). Whether a special environment is required for the coating is being investigated by means of pleural injection. Preliminary results suggest that acid mucopolysaccharides and colloidal iron both must be present.<sup>25,26</sup> In tissue cultures, even the smallest dust particles are taken up by macrophages and fibroblasts, but no typical asbestos bodies develop.<sup>27</sup>

#### NONASBESTOS FERRUGINOUS BODIES

Today, respirable fibers are legion. Diatomaceous earth, graphite and carbonium already have been identified as the core of typical "asbestos bodies" in man.<sup>28</sup> Substances believed to be biologically inert, including fibrous aluminum silicate (Fig. 5), fibrous glass (Fig. 6), silicon carbide and forsterite have caused ferruginous bodies in hamsters and guinea pigs.<sup>29</sup> Even fragments of the lung's own elastic tissue may produce "elastosis bodies" that look sim-



FIGURE 4. Section of the Lung of a 55-Year-Old Man Who Had Been an Asbestos-Sheet Sticker for Nine Years. Photomicrograph, Polarized Hematoxylin and Eosin Stain, Original Magnification X600.

4. The upper right area was previously shown to be a nest of bodies within a mesothelioma. The bodies are seen in the center of the field. Many are single bodies, some with the characteristic beaded appearance. The lower right area is a field of bodies at the bottom of a granuloma.