the other studies discussed above, have important implications for the study of fossil echinoderms because the length of time that an echinoderm decayed on the seafloor can be estimated based on the preservational condition of the specimen.

A particularly informative study on the taphonomy of fossil echinoderms was done by Brett et al. (1997a). They divided echinoderms into three different taphonomic grades based on the ease in which they became disarticulated. Then, they used these three taphonomic groups to define various "taphofacies" characteristic of certain sedimentary environments (Brett et al., 1997a).

The first taphonomic group (Type 1 echinoderms; Brett et al., 1997a) has plates that are held together only by soft tissues such as ligaments and muscles. It is not likely that Type 1 echinoderms will remain articulated for very long after death because their plates will be rapidly disarticulated by decay (Brett et al., 1997a). Examples of Type 1 echinoderms include asteroids, ophiuroids, eocrinoids, some edrioasteroids, and some homalozoans, as well as helicoplacoids. Naturally, Type 1 echinoderms rarely are preserved in the fossil record except as disarticulated skeletal ossicles, which are usually unidentifiable (Brett et al., 1997a). Only very rarely are Type 1 echinoderms preserved partially or wholly articulated (Brett et al., 1997a).

Portions of Type 2 echinoderm skeletons are more tightly articulated, whereas other portions are loosely articulated; examples include crinoids, cystoids, and many regular echinoids (Brett et al., 1997a). Because of the variation in their skeletal construction, Type 2 echinoderms are preserved in a wide range of taphonomic grades (Brett et al., 1997a).

Type 3 echinoderms have a skeleton that is almost entirely tightly articulated or sutured, as is typical of irregular echinoids and some crinoids and blastoids (Brett et al., 1997a). This group is very resistant to decay, which commonly entails breakage along sutures; hence, mostly disarticulated specimens indicate prolonged post-mortem seafloor exposure, probably in high energy environments (Brett et al., 1997a).

Given that the preservation of echinoderms, and, specifically, helicoplacoids, is dependent on the conditions of their physical burial, it is important to consider the burial, or obrution, events that are responsible for their preservation. Obrution deposits represent extremely rapid burial events during which the bodies of organisms are quickly and permanently buried by a large influx of sediment, not allowing for their decay on the seafloor (Brett et al., 1997b). There are four factors identified by Brett et al. (1997b) as necessary for an obrution deposit to form. First, numerous intact organisms, dead or alive, must be present on the seafloor during burial. Second, a relatively thick (1 mm to 1 cm) bed of sediment must be deposited rapidly. Third, there must be no later physical or biological reworking of the obrution layer. And, finally, there must be a favorable early diagenetic environment (Brett et al., 1997b).

Obrution events can have a variety of causes, including seismites, turbidites, and ash falls or flows (Seilacher, 1982; Clifton, 1988). In marine shelves, however, the most common initiators of obrution deposits are storms (Brett et al., 1997b). Storms cause erosional winnowing in coarse-grained nearshore settings, resulting in the basinward transport of fine-grained suspended sediment (Aigner, 1985; Clifton, 1988). These suspended sediments blanket offshore areas with a layer of fine sediment, resulting in the preservation in obrution deposits of any organisms unfortunate enough to have been present and unable to escape (Aigner, 1985; Clifton, 1988).

FIGURE 3—Photograph of the new helicoplacoid locality utilized in this research in Westgard Pass, White-Inyo Mountains, California. All specimens were collected from the talus slope seen here, despite extensive outcrop excavation. Hammer handle is approximately 1 meter long.

METHODS

To study the taphonomy of helicoplacoids, 107 specimens collected at a new helicoplacoid locality in Westgard Pass (37°17′45″ N, 118°08′15″ W; Fig. 3) and 39 specimens from the Los Angeles County Museum of Natural History (LACMNH) were examined carefully. Specimens collected are deposited at both the LACMNH and the Peabody Museum of Natural History, Yale University. Because the shales in the Middle Member of the Poleta Formation typically weather into talus slopes with little exposed outcrop, all specimens collected during this study were found on pieces of talus. Unfortunately, although almost 2 stratigraphic meters of available outcrop were excavated for X-radiographic purposes, no helicoplacoid specimens were found in their original stratigraphic position. In fact, no other outcrops are currently known that contain *in situ* helicoplacoids.

Specimens were categorized into one of three groups based on the quality of their preservation: (1) well-preserved with a slight amount of disarticulation (Fig. 4A); (2) partially disarticulated (Fig. 4B); and (3) almost fully disarticulated (Fig. 4C). The percentage of total helicoplacoid specimens in each group was calculated, as well as the percentage of specimens that share a bedding plane with other individuals. These percentages were used to characterize helicoplacoid preservation.

It should be noted that there may be a bias towards reduction in occurrences of almost fully disarticulated (Group 3) helicoplacoid specimens. This bias results from the fact that during specimen collection almost fully disarticulated specimens would have been more difficult to locate and collect because of their lack of any distinct