

TABLE 1—The percentages of helicoplacoid specimens at USC and the LACMNH in each taphonomic group. See text for explanation of taphonomic groups.

Taphonomic Group	USC %	LACMNH %
1	19	8
2	69	62
3	12	30

shelf environment that periodically received some slight disturbance by tempestites, an ideal setting for the formation and preservation of obrution deposits (Brett et al., 1997b).

Examination of X-radiographs from rocks in which these helicoplacoid specimens are preserved indicates that there are some sedimentological differences between lithologies that preserve Groups 1 and 3. Group 1 specimens generally are associated with thin (<2 cm), sometimes graded beds, but none of the 20 Group 1 specimens are associated with thick graded beds rich in bioclastic material. On the other hand, 46% (6 of 13) of Group 3 specimens are associated with thick (>2 cm) graded beds rich in bioclastic material. Group 2 specimens are associated with both of these end-members. It also is interesting to note that Group 1 and 3 specimens were never preserved together, but they were both preserved with Group 2 specimens.

X-radiographic evidence indicates that Group 3 specimens generally were preserved in higher energy regimes than Group 1 specimens, whereas Group 2 specimens were preserved in a broad range of energy regimes. An explanation for these observed differences may be that higher energy conditions aided in the almost complete disarticulation of many Group 3 specimens by further disarticulating them during transport (Kidwell and Baumiller, 1990). Many of the Group 3 specimens, for instance, probably would have been preserved as Group 2 specimens under lower energy conditions. Likewise, the Group 2 specimens preserved with the Group 3 specimens probably would have been preserved as Group 1 specimens under lower energy conditions. Hence, the fact that Group 1 and Group 3 specimens are not preserved together may simply be a function of their preservation in obrution events of differing energy levels, as supported by the sedimentological evidence.

The predominance of Group 2 specimens observed in this study is probably due to a combination of two factors: (1) many preserved helicoplacoid specimens may have undergone post-burial decay, and (2) many preserved helicoplacoid specimens may have already been dead and experienced some decay on the seafloor before their rapid burial in obrution events (Brett et al., 1997b). It is difficult to determine which of these two factors made a greater contribution towards this preservational pattern. It does seem likely, though, that some combination of pre-burial and post-burial decay contributed to the large percentage of Group 2 specimens observed in this study. Given the loosely articulated skeletal structure of helicoplacoids, it is not at all surprising that they are most commonly preserved partially disarticulated. Well-preserved specimens of Type 1 echinoderms are indeed extremely rare (Brett et al., 1997a).



FIGURE 5—Photograph of a portion of a bedding plane containing 17 helicoplacoid specimens, accompanied by numerous loose plates. Portion of a U.S. one cent coin for scale.

Not only were most helicoplacoid specimens assigned to Group 2, but 73% were preserved on the same bedding plane with at least one other individual, and 39% were found preserved on a bedding plane containing at least 10 individuals (Fig. 5). The fact that helicoplacoids most commonly are preserved with other individuals, and commonly with numerous other individuals, attests to both their gregarious nature and their frequent preservation in mass mortality events in which numerous individuals were killed either shortly before or during rapid burial (Brett et al., 1997b).

As discussed earlier, the specimens collected in this study were carefully examined to test the hypothesis that the lowermost region of the helicoplacoid body was more rigidly constructed than the rest of the organism. This examination revealed that 78% of the specimens had no preferential preservation; hence, no particular region of the body was better preserved than the rest of the individual. The lower region of the body was preserved preferentially in 15% of the specimens, whereas the upper region of the body was preserved preferentially in 7% of the specimens. Clearly, based on these numbers, there is no evidence that the lower region of the helicoplacoid body was constructed more rigidly than the rest of the individual. This result,