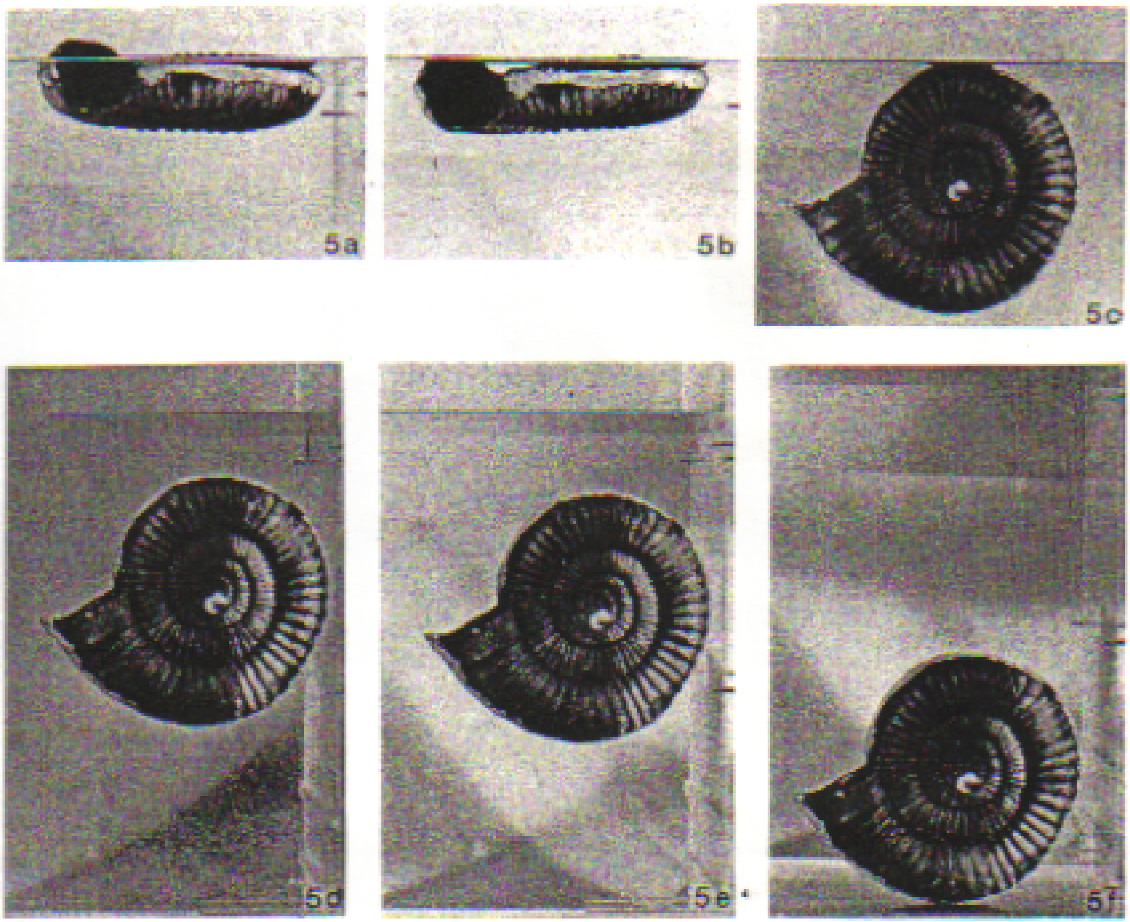

TEXT-FIG. 5. *Dactylioceras* sp. Toarcian (Jurassic). *a*, horizontal floating position of the empty shell. *b*, with the last three chambers liquid-filled, the shell just breaks the surface, remaining horizontally oriented. *c*, with the last four and a half chambers liquid-filled the shell is in hydrostatic equilibrium. *d*, held at 6 cm below the surface of the water, the shell floats to the surface. *e*, held at 7·5 cm below the surface of the water, the shell sinks slowly to the bottom. *f*, the resting position of *Dactylioceras* on the bottom of the tank.

In an earlier study (Reyment 1973), the effect of varying the length of the body chamber on the floating orientation of empty shells was the main topic of interest. In the present paper the body chamber was allowed to remain a constant length, the experiments being directed towards studying the relationships between the amount of liquid in the last chambers of the final whorl and the floating orientation of the shells.

Compared with Reyment (1958, 1973) and Mutvei and Reyment (1973), the work here summarized gives answers to several questions which could not be treated with the cruder models used in the earlier investigations.

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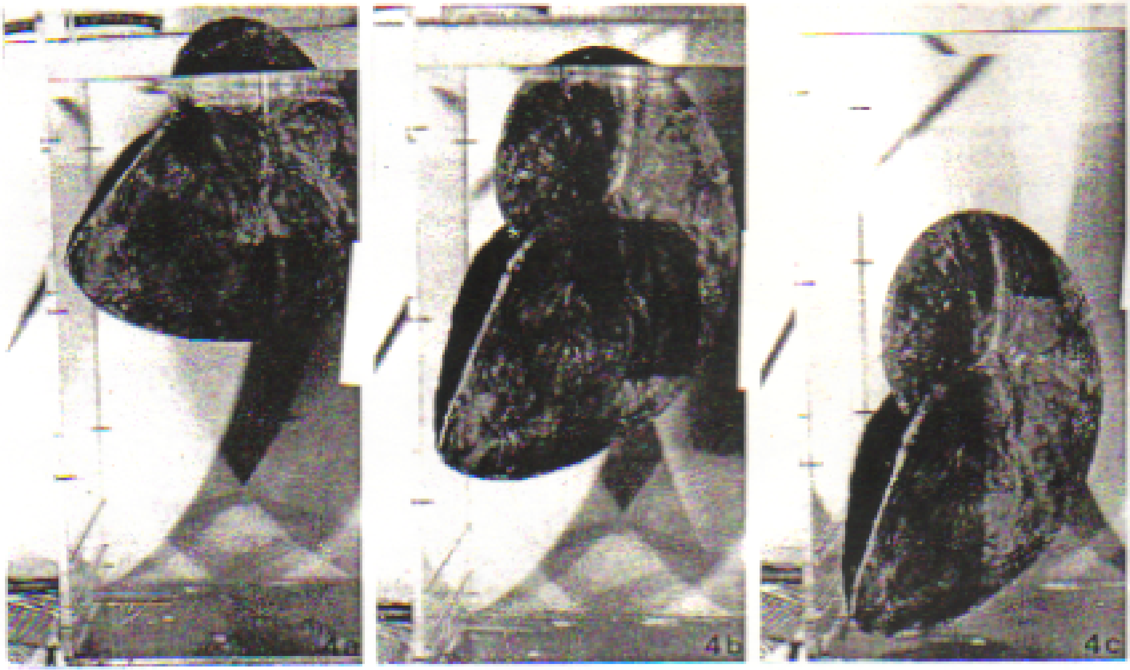

TEXT-FIG. 4. *Hoplitoides ingens* (von Loenen), Early Turonian (Cretaceous). *a*, floating position of empty shell. *b*, floating orientation with three last chambers liquid-filled. *c*, the shell sinks when the fourth chamber contains liquid.

3. Last four chambers liquid-filled: there is an abrupt change in orientation, and the shell becomes vertical. It floats upright and is reasonably stable; this is presumably the living position of the dactylioceratid animal. About 6% of the shell remains above water.

4. Last four and a half chambers liquid-filled: the shell does not break the surface of the water and sinks gradually to the bottom if struck sharply (text-fig. 5*c*).

5. If held at the depth indicated in text-fig. 5*d*, the shell rises slowly to the surface.

6. If held at the depth indicated in text-fig. 5*e*, the shell sinks slowly. In both stages (5) and (6) the shell contains the same amount of liquid. A motion picture is available of this part of the experiment. Careful frame-by-frame study shows that the serpenticone type of shell, as represented by *Dactylioceras*, reacts sluggishly to movement when in a state of buoyancy equilibrium. On the other hand, it appears to be as stable as, for example, the cadicone with respect to its vertical orientation.

7. Resting position of the model on the bottom of the tank (text-fig. 5*f*).

CONCLUDING REMARKS

The suite of experiments briefly reported here indicates the variability in stability shown by various kinds of ammonoid shell. The most stable of the types studied is represented by shells with depressed whorl sections; next, are shells with a sub-quadrate whorl section and a moderate degree of evolution. A highly compressed and involute shell form, such as possessed by many species of *Hoplitoides*, does not float in a vertical position when empty. The same observation applies for highly evolute, serpenticone shells of dactylioceratid type, which when empty float in a horizontal position. Serpenticones, when normally weighted with cameral liquid, appear remarkably sluggish when forces are applied to them.

REFERENCES

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