

DR2004140

## Appendix DR1

### Geological setting and accompanying fossil association

The material described herein was collected from the lower Meishucunian (equivalent to the Nemakit-Daldynian of Siberia) Shizhonggou section (Conway Morris and Chen, 1992) near Kuanchuanpu, Ningqiang County, Shaanxi Province (China). The section consists of 55 m of phosphatic carbonates, siltstones, and cherts. Phosphatized eggs and embryos occur within a 15 m interval of the upper *Anabarites trisulcatus*-*Protohertzina anabarica* Zone of the Kuanchuanpu Formation, providing the oldest fossil association of the earliest Cambrian bioradiation on the Yangtze Platform. The fossils were extracted from carbonate rocks using weak acetic acid. A particularly rich layer in the middle Kuanchuanpu Formation, containing 1.0 g eggs and embryos per kg rock, was exploited for biostatistical investigations. Biostratigraphic correlation with well-dated sequences (Grotzinger et al., 1995) yielded an absolute age of approximately 535 Myr for the embryo-containing strata. Apart from fossil embryos, the same beds also contain numerous disarticulated and phosphatized small shelly fossils (SSF). The interpretation and assignment of the earliest SSFs and phosphatized unsclerotized remains (cuticles, algae, bacteria, eggs) is still controversial, mainly due to their fragmentary preservation. *Anabarites trisulcatus*, *Conotheca subcurvata*, as well as different form-taxa of the *Siphogonuchites*/*Lopochites*/*Maikhanella*-group are the dominant species. *Protohertzina anabarica*, *P. unguliformis*, *Carinachites spinatus* and *Punctatus emeiensis* occur subdominantly. *Anabarites* has been interpreted as a cnidarian by various authors (Bengtson et al., 1990), although this affiliation remains uncertain. The bilateral-symmetrical siphogonuchitids were assigned to the Coeloscleritophora and are closely related to halkieriids and wiwaxiids (Bengtson et al., 1990). Wiwaxiids have been

considered as stem-group representatives of the annelids while brachiopods are thought to be derived from the halkieriids (Conway Morris and Peel, 1995) although a more direct stem-group relationship of halkieriids and wiwaxiids to molluscs has also been advocated (Runnegar, 1996). Species of *Protohertzina* represent protoconodonts, which have been compared with chaetognaths (McIlroy and Szaniawski, 2000; Szaniawski, 2002), and *Punctatus* has been interpreted as a scyphozoan cnidarian (Yue and Bengtson, 1999). It is worth to note that unequivocal arthropod fossils have not been reported from strata earlier than the late Meishucunian (equivalent to Tommotian) and a first major radiation of arthropods appeared world-wide in the Atdabanian (Brasier, 1989). However, arthropod ichnofossils have been recovered from the lower Meishucunian phosphorites containing SSF of first association on the Yangtze Platform, which indicate the existence of at least weakly sclerotized euarthropods (Weber and Zhu, 2003). Despite the uncertainties surrounding the affinities of the dispersed skeletal fossils, it is obvious that the eggs, embryos, and larvae are accompanied by a moderately diverse metazoan community having affinities to a variety of metazoan clades, including cnidarians, ecdysozoans, and lophotrochozoans.

## References

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**Figure DR1.** Size histogram of cultured eggs of the modern arthropod *Triops cancriformis*; n=60 (material kindly provided by Dr. Erich Eder; Vienna).

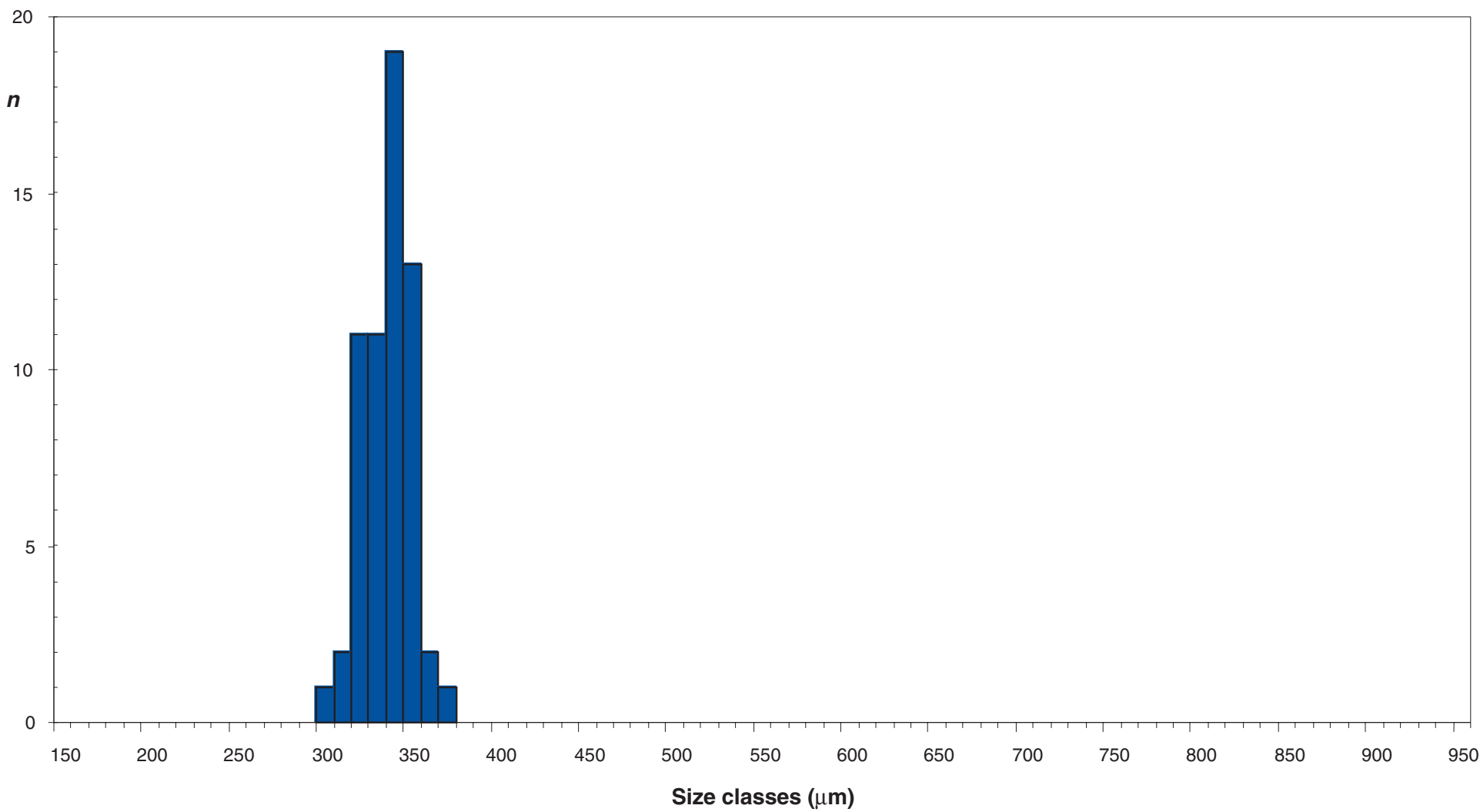
**Figure DR2.** Size histogram of Early Cambrian egg stages with smooth egg membrane, previously all treated as *Olivoooides multisulcatus*; n=504; all extracted from a single thin (2 cm) sediment layer of the Kuanchuanpu Formation at Shizhonggou, Kuanchuanpu, Shaanxi Province, China.

**Figure DR3.** Size histogram of Early Cambrian blastulas with holoblastic cleavage, which may represent different biospecies, including the later discoidal-type embryos with germ band formation; n=348; all extracted from a single thin (2 cm) sediment layer of the Kuanchuanpu Formation at Shizhonggou, Kuanchuanpu, Shaanxi Province, China.

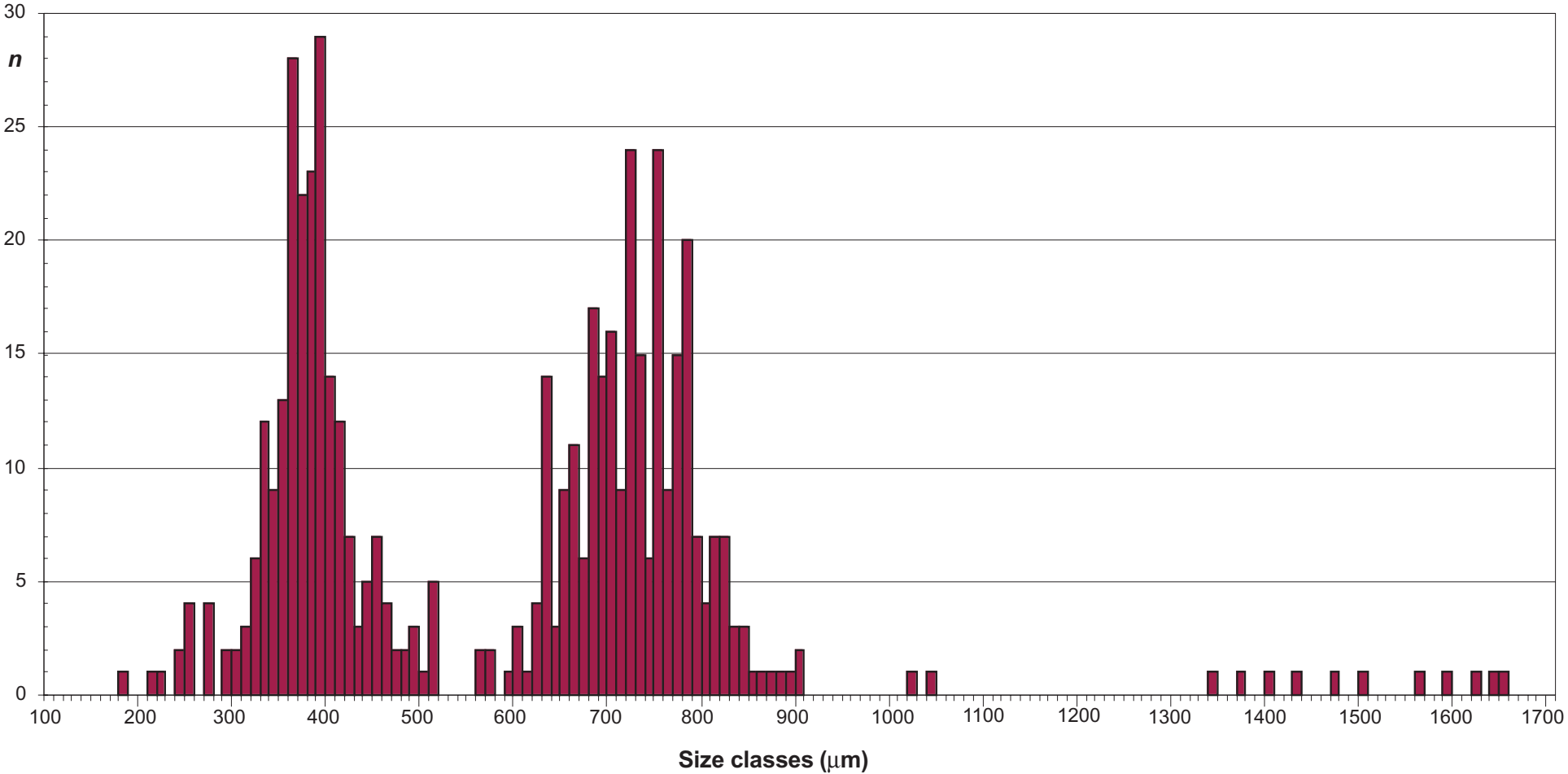
**Figure DR4.** Size histogram of Early Cambrian *Punctatus*-type embryos with stellate surface texture; n=208; all extracted from a single thin (2 cm) sediment layer of the Kuanchuanpu Formation at Shizhonggou, Kuanchuanpu, Shaanxi Province, China.

**Figure DR5.** Size histogram of Early Cambrian *Pseudoooides*-type embryos with germ band formation; n=206; all extracted from a single thin (2 cm) sediment layer of the Kuanchuanpu Formation at Shizhonggou, Kuanchuanpu, Shaanxi Province, China.

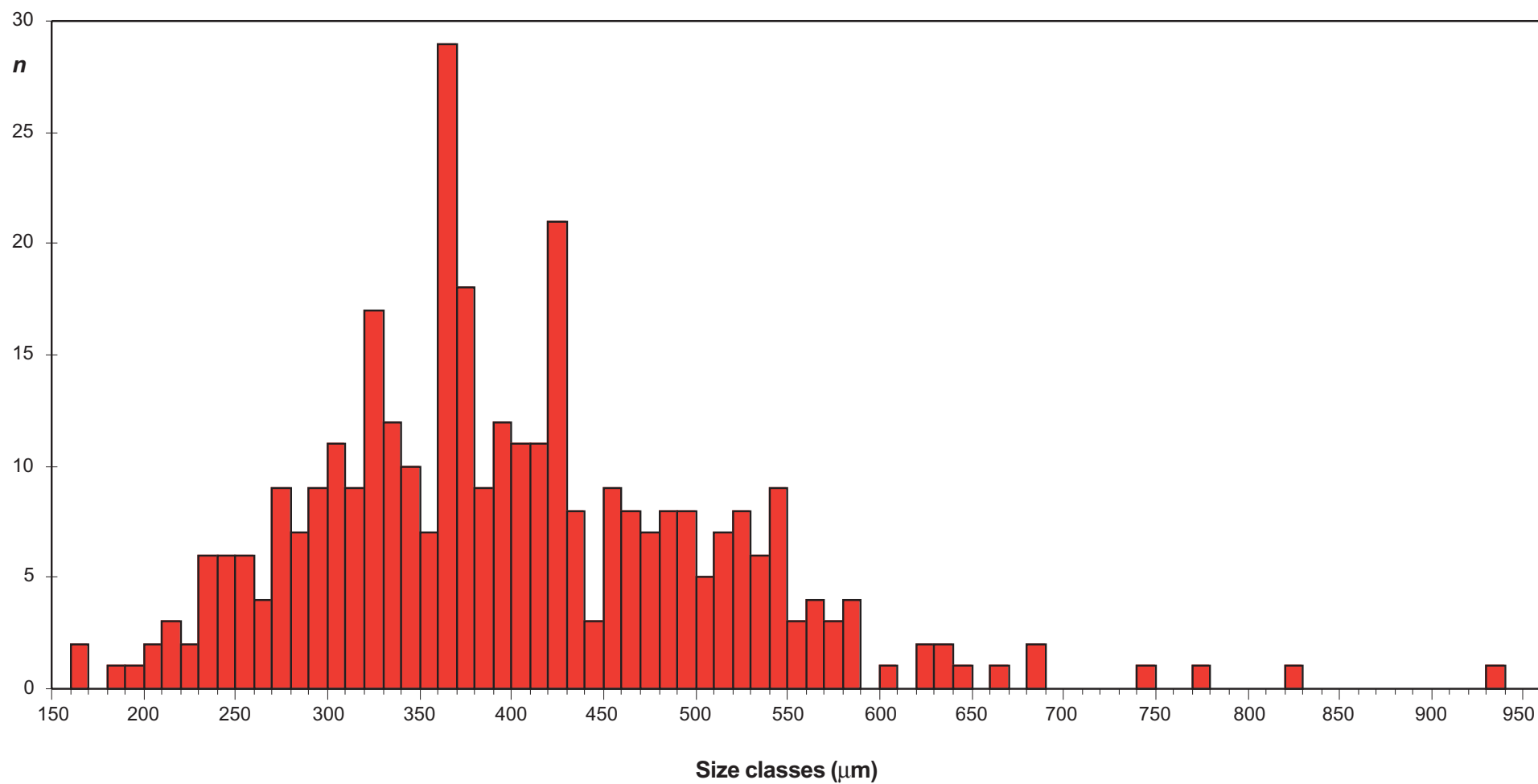
**Figure DR1. Size histogram of cultured eggs of the modern arthropod *Triops cancriformis*, n=60**



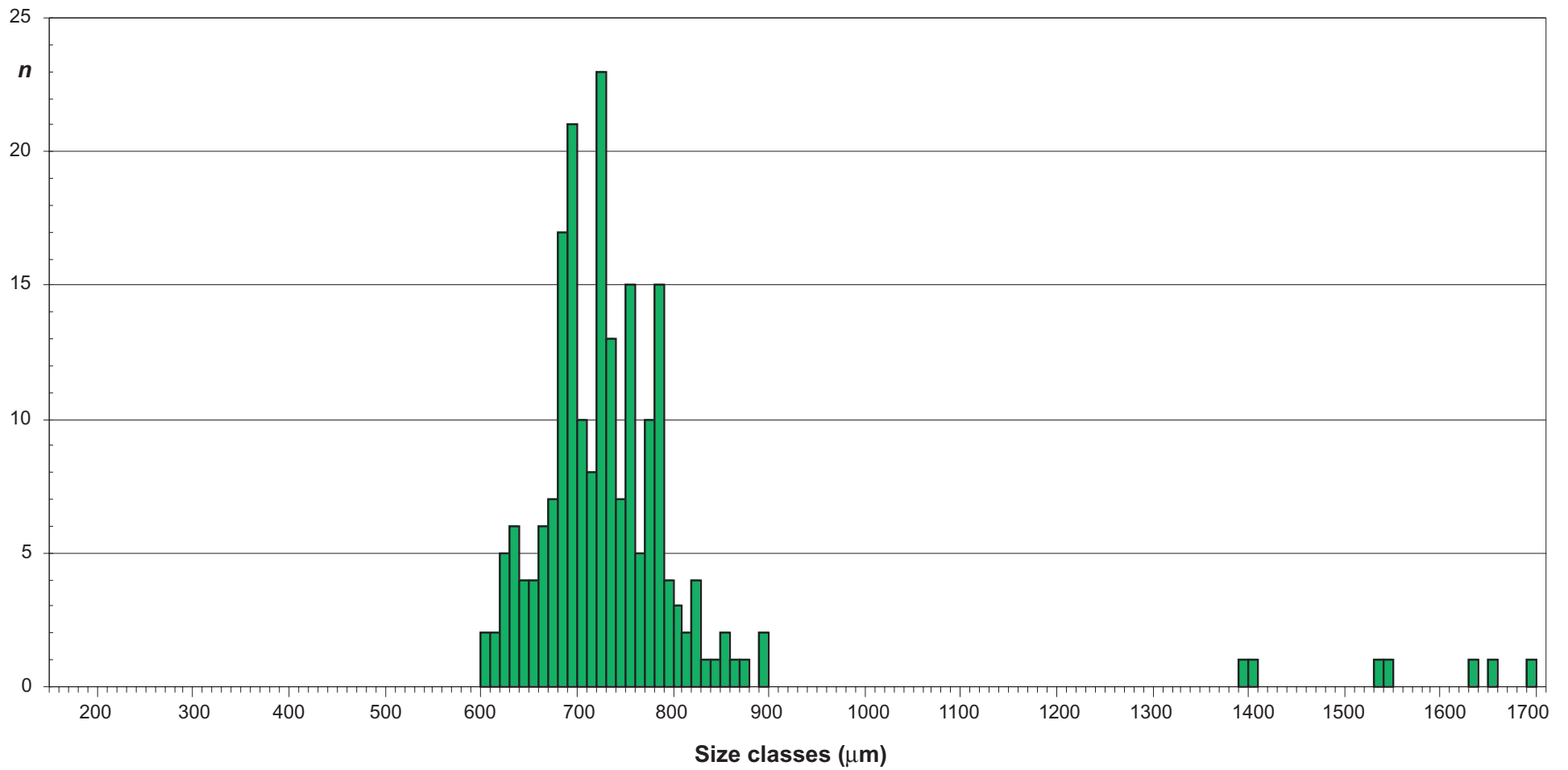
**Figure DR2. Size histogram of egg stages (previously all treated as *Olivoides multisulcatus*), n=504**



**Figure DR3. Size histogram of blastulas with holoblastic cleavage, n=348**



**Figure DR4. Size histogram of *Punctatus* -type embryos with stellate surface texture, n=208**



**Figure DR5. Size histogram of *Pseudoides*-type embryos with germ band formation, n=206**

