THE BIOSTRATIGRAPHY AND PALAEOECOLOGY OF SOUTH AUSTRALIAN PRECAMBRIAN STROMATOLITES

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SUMMARY

Precambrian stromatolites in South Australia are almost entirely restricted to the folded rock sequence of the Adelaide Geosyncline, a large, deeply subsiding basin with predominantly shallow-water sediments. The history of research into the age and fossils of the Precambrian rocks is reviewed, and a possible time-framework is suggested on the basis of available radiometric data.

Stromatolites, laminated structures formed by trapping of detritus and precipitation of chemical sediment by algae and bacteria, have been studied by other workers from at least two points of view: most Western authors regard stromatolite morphology to be purely environmentally determined, while one Russian school maintains that it is largely controlled by the algae present, and that stromatolites evolve as a consequence of the evolution of the algae forming them. They concluded this from an empirical study of widespread stromatolites of different ages, which made possible the biostratigraphic subdivision and correlation of many Late Precambrian sections.

The Russian methods of study and taxonomy have now been applied to South Australian stromatolites for the first time. Of the eighteen forms of columnar stromatolites described, five are identical or nearly identica to Russian forms. Nine forms are new, but sufficiently similar to Russia forms to allow inclusion in the same groups as these. Groups and forms must be defined on the basis of numerous characters, which may be given different relative weighting for different taxa. The taxa so defined

have restricted ranges in geological time.

Stromatolite correlation with the Russian sequence suggests that the Early Adelaidean (i.e. pre-tillite) beds are Middle Riphean; the Skillogalee Dolomite is youngest Middle Riphean, i.e. older than the Late Riphean Bitter Springs Formation of Central Australia. The Late Adelaidean Umberatana Group assemblage, correlated with the youngest Late Riphean, has seven groups in common with the Bitter Springs Formation, but unlike the latter, it overlies the lower tillite. A comparison with available radiometric data shows good agreement for the Umberatana Group, but some conflict with one recent age determination exists for the Early Adelaidean.

A study of the environments of growth of South Australian stromatolites shows that at least three forms, of widespread distribution, grew under a variety of conditions of energy, oxidation, type of sediment influx, and possibly salinity. The taxa defined are stable under these varying conditions, but there are minor modifications due to differences in environmental energy. Skillogalee Dolomite stromatolites grew under varying energy conditions on a very extensive and level carbonate depositing platform, frequently under hypersaline conditions. Umberatana Group stromatolites inhabited a marine environment, either in marginal littoral zones in the south-western and north-eastern Flinders Ranges, or on off-shore carbonate banks interpreted to be related to rising diapirs. In both cases, stromatolites formed during episodes of shallowing water depth.

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