

program

1973 ANNUAL MEETINGS

THE GEOLOGICAL SOCIETY OF AMERICA (85th)

THE PALEONTOLOGICAL SOCIETY (64th)

THE MINERALOGICAL SOCIETY OF AMERICA (53rd)

SOCIETY OF ECONOMIC GEOLOGISTS (52nd)

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SOCIETY OF VERTEBRATE PALEONTOLOGY

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**THE
GEOLOGICAL SOCIETY
OF AMERICA**

tooth development in horses). Hydromechanical analysis of temporal changes in nautiloid shell form suggests that the phylogenetic history of coiled nautiloids is also characterized by such a trend.

Drag coefficient (C_d) measurements and flow visualization data for a wide range of shell types show that shell streamlining is a function of five easily measured parameters. Streamlining estimates based on these parameters for a representative sample of over 140 genera drawn from all segments of nautiloid history indicate the following. Poorly streamlined shells (av $C_d \approx 0.8$) dominate Ordovician-Devonian faunas. Well streamlined shells (av $C_d < 0.2$) do not become common until post-Devonian times. Poorly streamlined and well streamlined shells are both common throughout the late Paleozoic and early Mesozoic, but after the Jurassic well streamlined shells become dominant.

Decrease in average C_d with time suggests a protracted trend toward better swimming ability. During the Paleozoic this trend is unrelated to variation in nautiloid diversity, indicating, perhaps, that these evolutionary crises involved many different nautiloid life styles. Post-Paleozoic diversity attenuation is associated with preferential loss of poorly streamlined species. Impetus for this trend may have come from competition with other swimmers, especially fish, ammonoids, and coleoid cephalopods. Nautiloid swimming adaptations lack the sophistication of those of fish and coleoids. The decline of nautiloids may thus reflect increasingly unfavorable competition with these better adapted swimmers.

THE CRYSTAL STRUCTURE OF CATAPLEIITE

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Catapleiite, $\text{Na}_2\text{ZrSi}_3\text{O}_9 \cdot 2\text{H}_2\text{O}$, from Mt. St. Hilaire, Quebec, is monoclinic (pseudo-hexagonal, pseudo-orthorhombic), I2/c with $a = 12.779$, $b = 7.419$, $c = 20.157\text{\AA}$, $\beta = 90.41^\circ$ and $Z = 8$. The structure was solved by a three-dimensional Patterson synthesis and was refined by a least-squares method to a final R value = 0.045. 2809 reflections, collected with $\text{Mn}^{\text{K}\alpha}$ radiation on a Picker four-circle diffractometer, were used. The structure of catapleiite is based on three-membered rings of SiO_4 tetrahedra, similar to the rings in wadeite ($\text{K}_2\text{ZrSi}_3\text{O}_9$) and benitoite ($\text{BaTiSi}_3\text{O}_9$), linked by Zr-octahedra and Na-polyhedra. The mean Si-O distances in the three independent SiO_4 tetrahedra are 1.620, 1.622 and 1.620\AA , all the bridging bonds being significantly ($\sim 0.05\text{\AA}$) longer than the non-bridging bonds. The bridging Si-O-Si angles are 134.2° , 133.2° and 134.1° . The two independent Zr atoms are each octahedrally coordinated with six oxygen atoms at mean distances of 2.070 and 2.071\AA . Na atoms are ordered in three of the four possible sets of special positions, and are coordinated with six oxygen atoms and two water molecules at mean distances of 2.566 , 2.575 and 2.585\AA . The phase transition to a hexagonal form at temperatures up to 230°C , reported in literature, may be explained as a result of disorder of Na atoms among all available sites and very minor shifts of other atoms. At least two orthorhombic forms can be derived theoretically by different manners of disorder of the Na atoms.