

ent at the same time, as is the case in the seminal vesicles of *Lumbricus terrestris*.¹

Of course, the behavior of mitochondria during the life cycle may be exactly similar in all species of *Monocystis*, but this has not yet been proved. In the meantime, until the particular species both of host and parasite investigated by the author be known, his results are invalidated by the possibility of the confusion of several species of *Monocystis*, the behavior of the mitochondria of each of which may be entirely different. As in other cases that might be mentioned, corroboration of the results obtained is impossible because of the anonymity in which the particular animal concerned is shrouded.

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BENTONITE IN THE ORDOVICIAN NEAR COLLINGWOOD, ONTARIO¹

EXAMINATION of samples from the Robert Cherry No. 1 well on the shore of Lake Huron about 2½ miles southeast of Collingwood, Ontario, showed bentonite in one sample from a depth of 320 feet. The material is light gray, soft, with a greasy feel. In water it expanded considerably and disintegrated rapidly. The residue after panning showed pyrite with biotite flakes up to 0.2 mm with subordinate amounts of zircon, apatite and tourmaline. Dr. C. S. Ross, of the U. S. Geological Survey, confirmed the bentonitic character of the material. He reported that the structure was very similar to that of the Ordovician bentonites found in Tennessee and Virginia, more especially to that found at Catawba, Virginia, that it showed the character of fine-grained pumice and that it was similar in physical properties and in contained biotite grains. An analysis for potash made by the Mines Branch, Department of Mines, Ottawa, Canada, showed 6.08 per cent. K₂O on material dried at 105° C.

The well samples show limestone down to the bentonite bed and for 35 feet below it to the basal sandstone resting on the Precambrian. The driller reported shale at 315 to 327 feet. The sample of bentonite was quite pure. It is possible therefore that the bentonite bed is several feet thick. The well started in the Trenton limestone but below the top of this formation which, together with the underlying Black River limestone, has a thickness at Collingwood of about 550 feet as shown by well records. No fossil evidence was obtained from the samples, and the exact horizon at which the bentonite occurs is not

known. It probably occurs in the upper part of the Black River limestone.

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THE RELATION OF THE PARANASAL SINUSES TO THE SINGING VOICE

ONE of the problems encountered in the teaching of singing is the determination of the potential range of the voice. It has been a matter for the ear of the teacher to decide, and in many cases the decisions have not been correct.

Many theories have been advanced regarding this phase of vocal work, among them that of laryngeal differences. None of them have proved conclusive to any degree of accuracy.

After some years of experimental research, using the x-ray as the exploring medium, the writer has made several discoveries that seem significant.

First, that the range of the voice seems to be governed by the length of the resonating space in the frontal sinuses. Practically all the cases examined have shown a direct relationship between the range of the voice and the size and shape of the frontal sinuses, sopranos having long, narrow, frontal sinuses, mezzo-sopranos shorter and broader ones, and altos very short and almost round ones. The cases examined have run unusually true to type.

Second, the size or weight of the voice seems to be governed by the size of the antri, clear light sopranos having smaller antri than those having larger, heavier voices.

Third, the naturally beautiful voices seem to have arches, palatal and pharyngeal, that are symmetrical in their make-up, well-arched cases having more beauty in their voices than those having flat arches.

In cases where technical difficulties have been encountered by students examined by the writer and who had the advantages of study and training by excellent teachers, malformation of the frontal sinuses was apparent. In several cases a variance in the length of the right and left sinuses seemed to be the cause of irregularities in the vocal scale.

The same anatomical differences with consequent vocal changes appear in male voices.

A thorough investigation is under way by the writer, and plans are now being formed to radiograph a large number of distinguished singers' heads.

In all cases great care must be used in making all films with definite angles as the work can be accomplished only through comparisons.

Any comment, critical or otherwise, will be welcomed.

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¹ Calkins and Bowling, *Biol. Bull.*, 51: 387, 1926.

² Published with the permission of the director of the Geological Survey, Canada.