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"A Method for the Investigation of Fossils by Serial Sections." By W. J. Sollas, D.Sc., LL.D., F.R.S., Professor of Geology and Palæontology in the University of Oxford. Received May 19,—Read June 11, 1903.

(Abstract.)

Mechanical difficulties preclude the study of fossils by serial thin slices, but serial polished surfaces may be obtained at any desired degree of proximity, and these, when the fossil and its matrix offer sufficient optical contrast, serve most of the purposes of thin slices. They may be photographed under the microscope, so as to furnish a trustworthy and permanent record. The sections may be used to obtain reconstructions of the fossil in wax. Several fossils have been successfully studied in this way: such as *Palæospondylus Gunni*, *Ophiura Egertoni*, *Lapworthura Miltoni*, *Monograptus priodon* and *Palæodiscus ferox*. The sections are obtained at regular intervals, usually of 0·025 mm., by means of an apparatus designed for the purpose by the Rev. F. Jervis-Smith, F.R.S., Reader of Mechanics in the University.

"An Account of the Devonian Fish, *Palæospondylus Gunni*, Traquair." By W. J. Sollas, D.Sc., LL.D., F.R.S., Professor of Geology and Palæontology in the University of Oxford, and Igerna B. J. Sollas, B.Sc., Lecturer in Zoology, Newnham College Cambridge. Received May 19,—Read June 11, 1903.

(Abstract.)

This fossil, which has been variously referred to an alliance with Lampreys, Tadpoles, and Lung-fish, has been successfully studied by means of serial sections. The ventral surface of the head bears four pairs of branchial bars, with the last of which two post-branchial plates, the so-called "post-occipital" plates, are associated; in front of the branchial bars are two pairs of structures, which are regarded as representing the lower jaw and hyoid; they are supported by a

suspensory apparatus, which may represent the palato-quadrate and hyo-mandibular elements. The branchial arches are wholly unlike anything seen in Marsipobranchs, but call to mind the similar structures in the Dipnoi and larval Amphibians. The dorsal side of the skull shows a large cranial cavity with thin vertical walls, but no complete roof, a pair of auditory and a pair of nasal capsules. The eye was situated over a structure which resembles a sub-orbital bar, but which is sub-divided into a hyo-mandibular and palato-quadrate element. At the anterior extremity of the skull are processes which may be compared with the rostal processes of Elasmobranchs. The vertebræ are cyclo-spondylous, with large neural arches.

The organism was evidently a primitive fish, with some features which are suggestive of Marsipobranchs, some of Elasmobranchs, and some of young Dipnoi or larval Amphibians; after branching off from the Piscine stem, at a point below the origin of the Elasmobranchs, it pursued an independent course of development.

The substance of which the fossil consists is a true coal: Coccosteus is sometimes similarly preserved, and an analysis of the latter, kindly made by Mr. J. E. Marsh, M.A., yielded the following results:—

Carbon	68·4
Hydrogen	4·5
Oxygen (by difference)	11·3
Ash	15·8
	100·0

Abstracting the ash, the residue closely resembles in composition an ordinary non-caking coal, such as that of South Staffordshire, as will be seen from the following table:—

	Coal from Coccosteus.	Non-caking Coal.
Carbon	81·1	79·39
Hydrogen	5·3	5·36
Oxygen (by difference)	13·6	15·25
	100·0	100·00

The skeleton of Coccosteus also occurs in a different state of fossilisation: in this the organic matter has disappeared, leaving a mineral residue, in which the original structure is preserved, and may be recognised as that of bone. Thus definite proof is afforded of a transformation, previously suspected, by which bone may be converted into coal.