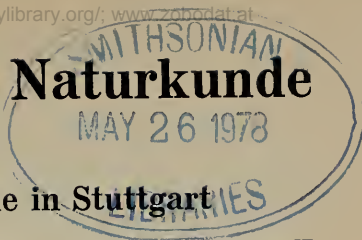


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## Remarks to the Aalenian of the Swabian Alb

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With 2 tables

In 1864 CH. MAYER used the term Aalenian — resp. “Etage aalénien, Aalen-Stufe, Aalenio, Aalen-series” — in his “Tableau synchronistique des terrains jurassiques” for the first time without any comments. He placed it between the Toarcian and the “Bath-series”. These stages had been founded by D’ORBIGNY and D’OMALIUS D’HALLOY. To specify the stratigraphic extension of the Aalenian, MAYER listed in his table of 1864 the following four names of layers and localities:

- Couches de Giengen ou à *Am. Sowerbyi*
- Couches de Cheltenham ou à *Am. Murchisonae*
- Couches de Gundershofen ou à *Trigonia navis*
- Couches de Boll ou à *Am. torulosus*.

1874 CH. MAYER put the “Couches de Gingen” to the Bajocian — he used the term “Bajocium” for the first time in this table. Therefore the Aalenian sensu MAYER 1874 ended with the “Couches de Cheltenham”. In further, not published tables (1881, 1884, 1888) MAYER kept up with unimportant retouchings (1884, 1888 he omitted the locality Boll, but kept the couches à *Am. torulosus*) the stratigraphic extension of the Aalenian he had chosen 1874.

Until the first “Colloque du jurassique, Luxembourg” (1962) the Aalenian was interpreted in different ways by various authors (Tab. 1). The reason for these different interpretations was that MAYER had not defined the boundaries of the Aalenian exactly, because the layers and localities had been chosen very unsuitably. Furthermore the new stage overlapped partially with the Toarcian, because D’ORBIGNY (1852, p. 464) included the „Opalinuston“ of Southwestern Germany to the Toarcian.

By the refinement and completion of the succession of zones resulted difficulties and disagreements concerning the position of the boundaries. Hence E. HAUG stated 1885 that the two lower zones of the Dogger (“Zone des *Ammonites torulosus*” and “Zone der *Trigonia navis*”) — proposed by A. OPPEL (1856) — contain the same fauna and therefore are only two contemporaneous sediments of different facies. *Trigonia navis* is not appropriate as an index fossil, because it has a very wide stratigraphic range and is dependent considerably on the variations of the facies.

The position of the lower boundary of the Bajocian of D'ORBIGNY has been interpreted differently for a long time. Detailed investigations of the type sections by J. GABILLY & M. RIOULT (1971) yielded, that the Bajocian sensu D'ORBIGNY begins with the zone of *Sonninia sowerbyi*. Consequently the lower boundary of this stage is situated between the zones of *Graphoceras concavum* and *Sonninia sowerbyi*.

The opinions whether the Aalenian should be kept as an independent stage between Toarcian and Bajocian or not vary a great deal. GABILLY & RIOULT (1971) proposed as a compromise to include the Aalenian as a substage into the Toarcian

Zones (Standard Zones) after MOUTERDE, ELMI et al. (1971)	Bajocian	Aalenian	Toarcian	Extension of Aalenian sensu various authors since D'ORBIGNY
Strenoceras subfurcatum				
Stephanoceras humphriesianum				
Otites souzei				
Sonninia sowerbyi				
Graphoceras concavum				
Ludwigia murchisonae				
Leioceras opalinum				
Peydella aalensis				
Dumortiera pseudoradiosa				
Hammatoceras insignis				
Grammoceras thouarsense				
Haugia variabilis				
				D'ORBIGNY (1852, S. 464; after GABILLY, 1964, S. 198)
				D'ORBIGNY (1850, S. 261-262; after RIOULT 1964, S. 250)
				MAYER (1864)
				MAYER (1874)
				HAUG (1892)
				HAUG (1910)
				ARKELL (1933, S. 165 and 189)
				ARKELL (1956)
				MOUTERDE (1961, S. 409)
				MAUBEUGE (1962/1964, S. 206)
				Colloque du Jurassique Luxembourg (1962/1964, recommendations)
				RIEBER (1963)
				HÖLDER (1964)
				MOUTERDE et al. (1971)
				* Aalenian as substage of Toarcian
				GABILLY and RIOULT (1967/1971)
				DUBAR, ELMI et al. (1967/1971, solution 4)

Tab. 1: The use and stratigraphic extension of the Aalenian related to the modern succession of zones (standard zones) by several authors since CH. MAYER 1864.

and consequently to attribute it to the Lias. There is, however, no agreement whether the Aalenian should be assigned to the Lias or to the Dogger (see GABILLY & RIOULT 1971).

The type locality of the Aalenian is the town of Aalen (75 km E of Stuttgart, SW Germany). P. L. MAUBEUGE (1964, p. 209) proposed an exposure near Atten-

hofen, a small village situated 8 km NNW Aalen, as stratotype of the Aalenian. However, in this section ammonites are rare and furthermore there is exposed only the upper part of the Aalenian. Actually these circumstances render the correlation with other regions more difficult. Altogether the development of the Aalenian in the region of Aalen differs remarkably, mainly in the upper part, from the development in the central and the western part of the Swabian Alb (regions of Balingen — Rottweil and Achdorf/Wutach). In these regions the Aalenian is considerably richer in ammonites. Hence there is to examine, if the stratotype — provided that it is actually suitable to define a stratotype — should be determined exactly in the region of Aalen. According to the names of layers and localities mentioned by MAYER, there is no reason to do so.

In the western part of the Swabian Alb H. RIEBER (1963) subdivided the Aalenian into zones and subzones (interpreted as standard zones and subzones) as listed in table 2. This succession corresponds to a large extent to that of the Aalenian resp. Lower Bajocian of Great Britain (according to ARKELL 1956). However, the succession of zones and subzones found by RIEBER was put in question by W. SPIEGLER (1966), but D. CONTINI (1966) and recently G. DUBAR, S. ELMi et al. (1971) confirmed and refined it.

The sediments of the lower part of the Aalenian, the so-called "Opalinuston" or "Braunjura  $\alpha$ ", are developed very constantly as more or less marly, dark-grey, shaly claystones, which become sandy towards the upper part in spite of their inconstant thickness. However, the upper part ("Murchisonae-Schichten") or "Braunjura  $\beta$ " corresponding to the *comptum* till *concovum* zones sensu RIEBER 1963) shows different developments in the various regions of the Swabian Alb.

The region of Aalen and Geislingen is especially famous for its iron ore deposits (red-brown, fine-oölitic, ferruginous sandstones), which alternate with sandstones, more or less sandy claystones, and limestones (H.-S. WEBER 1964). In the region between Kirchheim u. T. and Reutlingen (central part of the Swabian Alb) the Upper

Stages	RIEBER 1963		CONTINI 1969		DUBAR, ELMi et al. 1971 (Solution 4)	
	Zones	Subzones	Zones	Horizons resp. Subzones	Zones	Subzones resp. Horizons
Bajocian pp.	Discites		Discites	Hyperlioceras Formosum	Discites	Hyperlioceras Toxilioceras
Aalenian	Concovum		Concovum	?	Concovum	Haplopleuroceras Arcitenens
	Murchisonae	Bradfordiensis	Murchisonae	Gigantea	Murchisonae	Bradfordensis
		Discoidea		Murchisonae		Murchisonae
		Sehdensis		Sehdensis		Sinon
		Sinon		Opalinoidea		
	Comptum	Scisum	Comptum	Crassicosotatum Bifidatum Lineatum	Opalinum	Plicatellum
	Opalinum		Opalinum	Opalinoforme Subglabrum		Opalinum
Toarcian pp.	not listed		Aalensis	Buckmani	not listed	

Tab. 2: The succession of zones and subzones resp. horizons of the Aalenian according to H. RIEBER (1963), D. CONTINI (1969), and G. DUBAR & S. ELMi et al. (1971).

Aalenian consists of thick shaly claystones with a few ferruginous limestones. Ammonites are rare and restricted to the limestone layers. From the region of Balingen to the southwest the thickness of the layers of the Upper Aalenian decreases, but the number and mainly the thickness of the limestone layers increase. The majority of the partly chamosite oölitic limestone layers contains ammonites. Therefore it was possible to establish a detailed stratigraphic subdivision for this region. The so-called *concava*-bed in the uppermost part of the *murchisonae*-layers is a very tough limestone layer of about 15–20 cm thickness with many mud pebbles. It can be traced from the central to the most southwestern part of the Swabian Alb and is outstandingly suitable as a reference horizon.

The ammonites and the stratigraphy of the Aalenian of the Swabian Alb have been described in the last years by H. RIEBER (1963), H.-S. WEBER (1964), and U. BAYER (1969). In former times extensive studies were published by F. A. QUENSTEDT (1887), E. HORN (1909), and E. LÖRCHER (1939). A dominant element of the fauna of the Aalenian of southwestern Germany are the representatives of Graphoceratidae (*Leioceras* s. l., *Staufenia* s. l., *Ludwigia*, and *Graphoceras* s. l.). In addition to them representatives of the Hammatoceratidae [*Tmetoceras scissum* (BENECKE) and *Sonninia* (*Poecilomorphus*)] occur in scattered specimens.

*Tmetoceras scissum* (BENECKE) was found in the Upper Opalinuston of Boll and in the zone of *Leioceras comptum* of the western Swabian Alb. The following Hammatoceratidae are known thus far:

In the Upper Opalinuston of the region of Balingen: *Hammatoceras* sp. (not yet published); in the subzone of *Staufenia sinon* of Achdorf; *Erycites* sp. (not yet published); in the subzone of *Staufenia discoidea* of the western Alb: *Planammatoceras planiforme* BUCK. (in RIEBER 1963); in the subzone of *Ludwigia bradfordensis* near Achdorf: *Hammatoceras* aff. *planinsigne* VACEK (in RIEBER 1963) and various other not identified representatives of *Hammatoceras* (not yet published); in the zone of *Graphoceras concavum* of Metzingen: *Hammatoceras diatematoides* (MAYER), *Hammatoceras* aff. *subinsigne* (OPPEL) (in RIEBER 1963) and *Euaptetoceras* cf. *amplectens* (BUCK.) (in BAYER 1969). In the zone of *Graphoceras concavum* of Achdorf/Wutach were found by U. BAYER 1969: *Euaptetoceras euaptetum* (BUCK.) and *amplectens* (BUCK.), as well as *Eudmetoceras* aff. *eudmetum* BUCK. One specimen of *Sonninia* (*Poecilomorphus*) *boweri boweri* (BUCK.) and one of *S. (P.) schlumbergeri* (HAUG) were described by RIEBER 1963 from the zone of *Graphoceras concavum* of Metzingen (central part of the Swabian Alb).

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