

VEEL KORD KESK-DEVONI ABAVA KIHITIDEST

Elga Mark-Kurik ja Jüri Nemliher

Tallinna Tehnikaülikooli Geoloogia Instituut, Estonia pst. 7, 10143 Tallinn
(kurik@gi.ee; nemliher@gi.ee)

Abava kihid on kauaaegse asendi tõttu Kesk- ja Ülem-Devoni piiril põhjustanud rohkem vaidlusi kui mõni teine stratigraafiline üksus Baltikumi läbilõigetes. Selle asendiga seoses on neid kihte käsitletud kord iseseisva üksusena (Liepinš 1960, Mark-Kurik 1991), märksa sagedamini aga lasuva, Gauja lademe osana (Kuršs et al. 1981, Mark-Kurik 1981) või lamava, Burtnieki lademe osana (Kleesment 1995, Kleesment & Mark-Kurik 1997, Vingisaar 1997). Abava kihtide kui üksuse liitmist selle või teise kõrgemat järku üksusega on põhjustanud antud üksuse piiride, eriti ülemise piiri ebamäärasus ning halb jälgitavus geoloogilisel kaardistamisel (Kurik et al. 1989). Viimatimainitud asjaolu tõttu loobus Kuršs hiljem (1992) Abava kui iseseisva stratigraafilise üksuse kasutamisest. Siiski ei saa mainimata jätta Abava kihtidele spetsiifilist kalafaunat, samuti selle üksikelementide laia levikut Ida-Euroopa platvormil ning naaberaladel ja kaugemalgi ning nimetatud kihtide tähtsust regioonidevahelise korrelatsiooni aspektist (Mark-Kurik 1991, Ahlberg et al. 1999, Mark-Kurik et al. 1999).

Eestis kuuluvad Abava kihid Givet' ladejärgu Burtnieki lademesse, moodustades selle kolmanda ehk ülemise kihikompleksi. Kihtide paksus on 15,1–32 m. Need koosnevad heledavärvilisest peeneteralisest põimjaskihilisest liivakivist, ka peeneteralisest hallist, rohekas- või lillakashallist aleuroliidist. Aleuroliiti on antud üksuses enam kui 25 %. Samuti esineb selles halli või punakaspruuni savi. Kagu-Eesti puursüdamikas on Abava tasemelt leitud dolokivi ning domeriiti. Mineraloogiliselt on meie Vöhandu jõe äärsed paljandid ning Lätis paiknev Lejeji paljand sarnased (Kleesment 1995).

Eelpool mainitud paljand (stratotüüp) asub Kuramaal Venta jõgikonnas Abava jõe vasakul kaldal (suudmest 4 km ülesvoolu) Lejeji talu vastas. Siit on korduvalt kogutud Abava kihtidele iseloomulike kalade jäänuseid. Nende alusel eraldas Liepinš (1960) Givet' ladejärgu lasuvas osas välja iseseisva üksuse – Abava kihistu. Hiljem õnnestus vähesel määral kalu leida ka Lejejist allavoolu jäävast paljandist endise Muizaraji talu kohal (Kurik et al. 1989). Eestis paiknevad Abava kihtide parimad ning kalafossiile sisaldavad paljandid Vöhandu jõel Leevist allavoolu. Need on Essi ning Ratta müür Vöhandu vasakul kaldal (Mark-Kurik 1999a). Neist paljandeist pärinevad stratigraafiliselt oluliste kalade *Psammolepis abavica* Mark-Kurik, *Watsonosteus* sp.n.? ja *Microbrachius* sp. rohkearvulised leiud (Abava kihtide fauna täielikku nimekirja vt Mark-Kurik 2000). *Psammolepis abavica* esineb Kuramaal Lejeji paljandis, *Watsonosteus* aga Muizaraji paljandis. Peamiselt Lejejist kogutud materjali põhjal on kirjeldatud *Livosteus grandis* (Gross). See artrodiir on küll mitmes suhtes lähedane *Watsonosteus*'ele, kuid erineb viimasest massiivsemate luude ning väga jämeda ornamendi poolest. *Livosteus grandis*'e holotüüp (Gross 1933, Taf. III Fig. 13) pärineb aga hoopis Gauja jõgikonnast ühest Lencupe paljandist Cesisest põhja pool. 1984. a toimunud välitööd koos V. Kurssi ja L. Ljarskajaga õnnestus ka leida samast piirkonnast Abava kihtide faunaga paljandeid, milles esinesid *Psammolepis abavica*, *Livosteus* jt. Üks neist paljandeist asub Kalna veskest ~2–2,5 km allavoolu Lencupe paremal kaldal. Tuleb lisada, et juba 1933. a ning mitmes hilisemas töös viitab W. Gross seoses *Livosteus grandis*'e jt leidudega Lencupelt selle kalataseme üleminekulisele vanusele (kaasaegses mõistes Burtnieki – Gauja üliminekufaunale).

Abava kihid sisaldavad mitmeid kalu, mida saab kasutada juhtkivististena, ka kalatsoonide tähistena. Nendeks on psammosteiid *Psammolepis abavica* Mark-Kurik (tuntud küll ainult Baltikumist), artrodiir *Watsonosteus* ja antiarh *Microbrachius*. Neist kaks esimest ongi ära märkimist leidnud kui Abava taseme juhtkivistised (Mark-Kurik 2000). Baltikumi piires võib nimetatud kaladele lisada ka artrodiiri *Livosteus*. Kaua aega oli antud perekond teada ainult Lätist, hiljem sai see tuntuks ka Eestist. *Livosteus*'e leiukohaks on meil vana savikarjäär Vastse-Nursis Võrumaal Rõugest loodes, täpsemalt Võru-Valga maanteest u 1,5 km loodes Rõuge jõe vasakul kaldal. 1975. a ekspeditsioonil, kaevates lahti aluspõhja kivimeid, saadi siit ~1 m paksuses punast savi, mille sees oli laiguti või läätседena helepunakaslilla savi ning lasumis õhuke sinakashalli aleuroliidi kiht. Savi ja aleuroliidi kontakt oli

sopiline. Lahtisest materjalist võis leida rohkesti fragmentaarseid kalajäänuseid. *Livosteus*´e robustse, tiheda kümmulise ornamendiga kaetud fragmendid on teiste seas hästi ära tuntavad. Sellist ornamenta pole ühelgi Baltikumi Devonist tuntud rüükalal. Tuberklite läbimõõt on kuni 2 – 3 mm, fragmentide paksus kuni 13 mm. Kalakompleksi kuuluvad veel: *Psammolepis abavica*?, *Coccosteoides* (väike vorm), *Asterolepis* sp. indet., *Glyptolepis* sp., *Laccognathus* sp., osteolepidiidid (suur? vorm) ja tristihopteriidid(?). Vastse-Nursi leiukohast jämedates joontes 3 km lõunas paikneb Hinni sälkorg, kus paljandub Gauja lademe alumise osa heledavärviline põimjaskihiline liivakivi (Kleesment 2001). Selles leidub pesadena väga jämedaid kvartsiveeriseid. Lõuna-Eesti aluspõhja üldiseid lasuvustingimusi arvestades on eelmainitud paljandite vanuseline (Abava-Gauja) järgnevus igati loogiline. Nii Eestis kui ka Lätis on võimalik Abava kihte tinglikult jaotada kahte ossa. Alumise osa juhtkivistiseks on *Watsonosteus*, ülemisel *Livosteus*. Pole välistatud, et *Livosteus* esineb vaid antud kihtide kõige ülemises osas. Ka on selle rüükala levik võrreldes *Watsonosteus*´ega märksa piiratum.

Omaette probleemiks on Väimelast põhja pool asunud Joosu savileiukoha stratigraafilise asend. See maardla on küll tänapäevaks ammendatud, kuid kunagise fossiilsete kalade ning flora leiukohana oluline ja unikaalne (Tallinn et al. 1970). Siit pärinevad muguljad lapikud fosfaatsed konkretsioonid läbimõõduga kuni 20 cm. Need sisaldavad mitmesuguste kalade (psammosteiidide, lihasuimsete e sarkopteriütigide) soomuskatte osi ja muid skeletiosi (Kuršs 1992, Mark-Kurik 1993). Meil pole selliseid kalajäänustega konkretsioone mujalt leitud. Küll on aga teistes regioonides, nt Šotimaa Devonis, kalade esinemine muguljates konkretsioonides üsna tavaline. Lisaks nimetatud konkretsioonidele on Joosust kirjeldatud ka iseäralikke tähekujulisi karbonaatseid konkretsioone ning götiidi-hematiidi konkretsioone (Kuršs 1992). Joosu hallist savist pärinevad *Watsonosteus*´e haruldased leiud – pea- ja kehartüü koos sisekolju elementidega. Neid algselt kõhrest ning õhukese luuümbrisega elemente pole mujalt leitud. Unikaalne on ka teise artrodiiri – *Actinolepis magna* sisekolju koos seda katva koljukaanega. Üalmainitud haruldased kalafossiilid leidis V. Räägel. Joosust on kirjeldatud sõnajalgtaim *Pseudosporochnus estonicus* (Kalamees 1988). Sama leiukoha savist võis leida lehtjalalise *Glyptasmussia* kodasid.

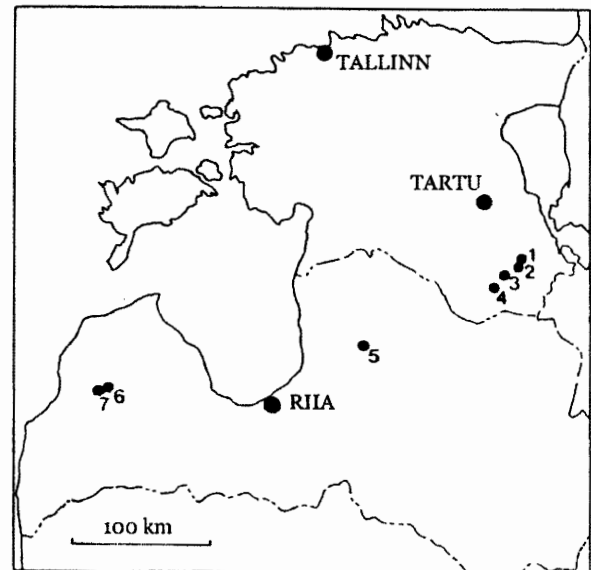
Kuršs (1992), lähtudes Devoni setete tsüklilisest ehitusest, eraldas Baltikumi idaosas (üldjoontes Võrtsjärvest ida ja kagu pool) Burtnieki lademes välja kaks kihistut. Ülemise kihistu stratotüübiks valis ta Joosu karjääri ning võttis vastavalt kasutusele nimetuse Joosu kihistu. Kihistut eraldab nii lamamist kui ka lasumist lünk. Kalaleidude põhjal ei saa aga Joosu taset lugeda tüüpiliseks Burtnieki lademe osaks. Viimast iseloomustab suurte artrodiiride (*Homostius*, *Heterostius*) ning lõuatu *Pycnosteus tuberculatus* esinemine nii Lätis kui ka meil. Hinni – Vastse-Nursi joonele loode suunas jääb kaks sellise faunakooslusega leiukohta – Sõmerpalu ning Sulbi Võhandu e Pühajõel (viimati mainitud looduslik paljand küll kaasajal ei eksisteeri, kuid omal ajal koguti siit hulgaliselt kalade materjali). Joosut ja Vastse-Nursit võib kalafaunast ja litoloogiast lähtudes lugeda Abava kihtide ülemiseks savikaks osaks. Võhandu jõe äärsed madalamal ürgorus paiknevad paljandid esindavad samade kihtide alumist valdavalt liivakivist koosnevat osa. Kolmanda kivimitüübina esineb mõlemas osas aleuroliit.

Tuleb tähelepanu juhtida mõningatele fossiilsetele kaladele, millel on olnud oluline osa Abava kihtide stratigraafilise asendi määramisel ning millel on baseerunud nende kihtide fauna nn üleminekuline iseloom. Need on *Ganosteus stellatus* ning suur *Asterolepis*´e vorm (*ornata-radiata* rühmast). Esimene neist on väga pika vertikaalse levikuga (Mark-Kurik 2000). *G. stellatus* on iseloomulik Burtnieki lademele, kuid seda on leitud ka (kuigi harva) koguni tüüpilistes Gauja lademe alumise osa paljandites Lätis Gauja ja Brasla jõel. Abava kihtidest alates kuni Amata lademeni (k.a) levivad suured antiarh *Asterolepis*´e liigid – *A. essica*, *A. ornata* ja *A. radiata*. Neid liike pole fragmentide põhjal võimalik täpsemalt määrata. Lihasuimne *Laccognathus* oli varem teada vaid Gauja-Amata tasemest. Tegelikult ilmub see perekond juba varem. Lejeji paljandit peeti kaua aega Kesk-Hilis-Devoni segafaunaga paljandiks, kuid paigutati suure *Asterolepis*´e (arvatava *A. ornata*) esinemise tõttu Gauja lademe alumisse ossa.

Abava kihte on võimalik korreleerida nii lääne, lõuna kui ka kirde suunas. Šotimaal on nende kihtide vanuselisteks analoogideks John o´Groats´i Group ja Eday Flags (Mark-Kurik 1991, Ahlberg et al. 1999). Nendes ühikutes esinevad plakodermid *Microbrachius* ja *Watsonosteus*. Viimast on leitud ka Põhja-Prantsusmaalt Givet´ vanusega Blacourt´i ja Beaulieu kihistuid (Lelièvre et al. 1988).

Tabel 1. Kesk-Devoni Abava kihtidele iseloomulikke kalu Eestist ja Lätist.

Paljandid	Essi Vöhandu j	Ratta müür	Joosu	Vastse-Nursi Rõuge	Kalna Lencupe j	Muizaraji Abava j	Lejeji Abava j
Kalad							
<i>Psammolepis abavica</i>	•	•		•	•		•
<i>Livosteus</i>				•	•		•
<i>Watsonosteus</i>	•	•	•			•	
<i>Microbrachius</i>	•		?				
<i>Asterolepis</i> (suur vorm)	•	•		•	•	•	•
<i>Cheirolepis gaugeri</i>	•						
<i>Laccognathus</i>	•	•		•	?		

**Joonis 1.** Abava kihtide kalaleiukohad Eestis ja Lätis: 1 – Essi müür, 2 – Ratta müür (1, 2 Vöhandu j ääres), 3 – Joosu, 4 – Vastse-Nursi, 5 – Kalna Lencupe j, 6 – Lejeji, 7 – Muizaraji (6, 7 Abava j ääres).

Üks *Watsonosteus* e leide pärineb Leedust Krekenava puursüdamikust 122 m sügavuselt Šventoji lademe alumisest osast (Ivanov 1992). Lademe alumine piir on Krekenava puuraugus 150,2 m sügavusel, lademe paksus on 85,9 m (Paškevicius 1997). 137 m sügavuselt on määratud ka *Laccognathus* sp. Nimetatud puuraugus, nagu paljudes teisteski Leedu puuraukudes Šventoji lademe piires Gauja ja Amata kihistuid välja ei eraldada. Ka pole Abava kihte ei Šventoji lademest ega lamavast Upinkai kihikompleksi ülemisest, Butkunai kihistust eristatud.

Valgevenes võiks Abava kihtidele vastata Polotski lademe ülemine, Morotši kihistu (Mark-Kurik 2000). Morotši kihistus esineb antiarh *Microbrachius* või sellele väga lähedane perekond koos paleoniskoidi *Cheirolepis gaugeri* ja *Laccognathus* sp.-ga. Meil on nii *Microbrachius* kui ka *Cheirolepis gaugeri* Gross ning *Laccognathus* teada Abava kihtidest. Morotši kihistu kuulub Givet' ajajärku (Mahnatš et al. 2001). Kirdes, Põhja-Timani piirkonnas võiks samuti leiduda Abava analooge Pašijski kihistu tasemelt (Sorokin 1996). Veelgi kaugemal, Siberi arktilises osas Severnaja Zemlja saarestikus võib tõenäoliselt leida samuti Abava kihtide analooge (Mark-Kurik 1999b) Siin esineb Kesk-Devoni ülemises osas Gremjaštši kihistus perekond *Watsonosteus*.

Kuigi Abava kihid moodustavad Eesti Devonis alamt järku üksuse ning on naaberaladel nt Lätis (Stinkulis 1999) koguni jäänud välja eraldamata, pakuvad need siiski omanäolise stratigraafilise tasemena suurt huvi ning on ka regionidevahelise korrelatsiooni seisukohalt olulised. Erilist tähelepanu pälvivad neist kihtidest leitud kõhrkalade (*Chondrichthyes*) suuõõne-neelu soomused, mis on veel teada ka koos suuhammastega Aruküla lademe Viljandi kihtidest. Abava kihid on väärt, et ka tulevikus nende uurimiseks spetsiaalselt tegeleda.

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Kasutatud kirjandus

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Once more on the Middle Devonian Abava Beds

Elga Mark-Kurik and Jüri Nemliher

Institute of Geology at Tallinn University of Technology, Estonia Avenue 7, 10143
Tallinn

(kurik@gi.ee; nemliher@gi.ee)

[NB! Present address of the Institute is Ehitajate tee 5, 19086 Tallinn]

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The Abava Beds, occupying for a long time a position at the Middle and Upper Devonian boundary, have caused more discussions than some other stratigraphical unit in the Baltic sections. The particular position was a reason why the beds have been considered as a separate unit (Liepiņš 1960, Mark-Kurik 1991) or more often either as a part of the overlying Gauja Regional Stage (Kuršs et al. 1981, Mark-Kurik 1981) or the underlying Burtņieki RS (Kleesment 1995, Kleesment & Mark-Kurik 1997, Vingisaar 1997). Unclear boundaries, in particular its ambiguous upper boundary, which were hard to map were the reasons why the Abava Beds were joined to one or another unit of higher rank (Kurik et al. 1989). That is why Kuršs later (1992) gave up to consider Abava as a separate stratigraphical unit. However, it is worth to mention the specific character of the fish fossils of the Abava Beds as well as their wide range on the East European Platform and in adjacent areas and even farther off, and significance of the beds for the interregional correlation (Mark-Kurik 1991, Ahlberg et al. 1999, Mark-Kurik et al. 1999).

In Estonia the Abava Beds are included into the Givetian Burtņieki RS, forming its third or upper part. Their thickness is from 15.1 to 32 m. The beds consist of light-coloured fine-grained cross-bedded sandstone and fine-grained gray, greenish- or reddish-gray siltstone. Siltstone forms more than 25% of the unit. It contains also gray or reddish brown clay, and in southeastern drill cores also dolostone and domerite. The outcrops on our Võhandu River and Lējeji exposure in Latvia are mineralogically similar (Kleesment 1995).

The above mentioned outcrop (stratotype) is in Kurzeme, in the Venta River basin on the left bank of the Abava River (4 km upstream of its mouth) opposite the previous Lējeji farmstead. Fish remains, characteristic of the Abava Beds have been collected here many times. Liepiņš (1960), based on these fishes, established in the upper part of the Givetian a separate unit, the Abava Formation. Later some few fish remains were discovered also in an exposure downstream of Lējeji at the former farm Muižaraji (Kurik et al. 1989). In Estonia the best outcrops and fish localities of the Abava Beds are on the Võhandu R. downstream of Leevi. These are Essi and Ratta müür (müür = ‘wall’ in Estonian) on the left bank on the Võhandu R. (Mark-Kurik 1999a). These outcrops have yielded numerous finds of the stratigraphically important fishes: *Psammolepis abavica* Mark-Kurik, *Watsonosteus* sp.n.? and *Microbrachius* sp. (for the complete list of the fauna of the

Abava Beds see Mark-Kurik 2000). In Kurzeme *Psammolepis abavica* occurs in the Lējeji outcrop, whereas *Watsonosteus* on the Muižaraji exposure. *Livosteus grandis* (Gross) was described on the basis of the material collected mainly in the Lējeji. This arthrodire is close to *Watsonosteus* from several aspects but differs from it with more massive bones and very coarse ornament. But the holotype of *Livosteus grandis* (Gross 1933, Pl. III fig. 13) comes from the Gauja River basin from one of the outcrops on the Lenčupe to the North of Cēsis. During the field work in 1984 together with V. Kuršs and L. Lyarskaya, localities of the fauna of the Abava Beds were discovered in the same area, including *Psammolepis abavica*, *Livosteus* etc. One of these outcrops is about 2 – 2.5 km downstream of the Kalna watermill on the right bank of the Lenčupe. It can be added that W. Gross already in 1933 and in some his later papers mentioned the transitional character (in recent terms the Burtņieki – Gauja transitional fauna) of the fossil fish occurrences on the Lenčupe, including *Livosteus grandis* etc.

The Abava Beds contain several fishes, which can be used as key-fossils and index fossils of a fish zone. These are psammosteid *Psammolepis abavica* Mark-Kurik (still known from the Baltic area only), the arthrodire *Watsonosteus* and antiarch *Microbrachius*. The two former fishes have been mentioned as the key-fossils of the Abava level (Mark-Kurik 2000). The arthrodire *Livosteus* can also be added to above fishes in the Baltic area. For a long time this genus was known only from Latvia; later it was discovered also in Estonia. In the latter, *Livosteus* occurs in the old Vastse-Nursi clay quarry in Võrumaa (= Võru county), NW of Rõuge, about 1.5 km to NW from the Võru-Valga highway, on the left bank of the Rõuge River. In 1975 about 1 m of red clay was exposed that contained as patches or lenses light-colored reddish-violet clay and was overlain by thin bluish-gray siltstone layer. The contact of clay and siltstone was with pockets. Talus yielded a lot of fish fragments. *Livosteus* fragments covered with coarse tense tubercles are easy to identify. None of the Baltic Devonian placoderms has this kind of ornament. Diameter of tubercles is up to 2-3 mm, thickness of fragments reach 13 mm. Fish assemblage of the locality includes also *Psammolepis abavica*?, a coccosteid (small form), *Asterolepis* sp.indet., *Glyptolepis* sp., *Laccognathus* sp., an osteolepidid (large? form) and a tristichopterid(?). In the Hinni gorge, about 3 km southward of the Vaste-Nursi locality, light-colored cross-bedded sandstone of the lower part of the Gauja RSt crops out (Kleesment 2001). There are lenses of very large quartz grains in sandstone. According to the general bedding conditions of South-Estonia the succession of Abava-Gauja exposures is quite acceptable. It is probable that the Abava Beds can be subdivided in two parts both in Estonia and Latvia. The key fossil of the lower part is *Watsonosteus* and that of the upper part *Livosteus*. It is not excluded that *Livosteus* occurs only in the uppermost part of the Abava Beds, and range of this arthrodire is more limited than that of *Watsonosteus*.

Stratigraphical position of the Joosu clay quarry northward of Väimela presents a special problem. Though in the present time the quarry does not function any more, it is still important and unique as former locality of fossil fishes and flora (Tallinn et al. 1970). Here flat nodular phosphatic concretions with diameter up to 20 cm were discovered. They contain parts of squamation and other skeletal remains of different fishes (psammosteids, sarcopterygians) (Kuršs 1992, Mark-Kurik 1993). In Estonia such

concretions are unknown from other localities. But in the other regions, e.g. in Scotland occurrence of fishes in nodular concretions is rather common in the Devonian. Joosu has yielded in addition to these concretions also peculiar star-shaped carbonate concretions and goethite-hematite concretions (Kuršs 1992). A unique specimen of *Watsonosteus*, consisting of its head and trunk shields with ossified endoskeletal elements preserved together with exoskeleton comes from Joosu gray clay. These cartilaginous and slightly ossified elements have not been found elsewhere in Estonia. Unique is also an endocranium of another arthrodire, *Actinolepis magna*, found together with its skull roof. Geologist V. Räägel collected these rare fish fossils. A fossil fern, *Pseudosporochnus estonicus* (Kalamees 1988) was described from Joosu, and there occurred also shells of the conchostracan *Glyptasmussia*.

Kuršs (1992), based on the cyclic structure of the Devonian deposits, distinguished in the eastern part of Baltic (roughly to the East and South-East of the Võrtsjärv Lake) two formations in the Burtneki RS. He selected Joosu quarry as the stratotype of the upper formation, and accordingly, used the unit name - the Joosu Formation. Gaps separate the formation from the underlying and overlying strata. However, fossil fish remains do not permit to consider the Joosu level as a typical part of the Burtneki RS. This stage is characterized by occurrence of large arthrodires (*Homostius*, *Heterostius*) and the agnathan *Pycnosteus tuberculatus*, both in Latvia and Estonia. There are two localities, Sulbi and Sõmerpalu upstream of the Võhandu (Pühajõgi) River, containing this faunal assemblage. The localities are situated to the North-West of the Hinni – Vastse-Nursi line. As to the Sulbi locality, it does not exist any more as a natural outcrop but earlier it revealed numerous fish finds. The fish fauna and lithological content of Joosu and Vastse-Nursi localities show that they can be considered as the upper clayey part of the Abava Beds. The exposures downstream of the Võhandu River, Essi and Ratta müür, situated deeper, on the slopes of an ancient valley, belong to the lower sandstone part of the Abava beds. Both parts of the unit contain siltstone. [Remark: Joosu with *Watsonosteus* has quite probably an earlier age in comparison with Vastse-Nursi, containing *Livosteus*. E. M.-K., June 2010].

There are some fossil fishes of note that have been significant in determination of the stratigraphical position and the transitional character of the Abava Beds. Among them are *Ganosteus stellatus* and a large form of *Asterolepis*, belonging to the *ornata-radiata* group. *G. stellatus* has very long range (Mark-Kurik 2000). It is characteristic of the Burtneki RS but it has, though rarely, been also discovered in the exposures of the lower part of the Gauja RS on the Gauja and Brasla rivers in Latvia. Large species of the antiarch *Asterolepis*, *A. essica*, *A. ornata* and *A. radiata*, range from the Abava Beds and further up to the Amata RS incl. It is not always possible to identify these species by fragments. The sarcopterygian *Laccognathus* was earlier known only from the Gauja-Amata level. Actually, the genus appears already earlier. [E.g., in Ratta müür *Laccognathus* is fairly common. Remark by E. M.-K., June 2010]. The Lējeji outcrop was, for a long time, considered as an exposure with the mixed Middle-Late Devonian fauna. However, the occurrence of a large *Asterolepis* (supposed to be *A. ornata*) was the reason why the outcrop was included into the lower part of the Gauja RS.

The Abava Beds can be correlated with the local units of the other regions to the west, south and north-east from the Baltic area. In Scotland the coeval units of these beds are the John o'Groats Group and Eday Flags (Mark-Kurik 1991, Ahlberg et al. 1999). The placoderms *Microbrachius* and *Watsonosteus* occur in these units. *Watsonosteus* has also been discovered in the Givetian Blacourt and Beaulieu Formations in the northern France (Lelièvre et al. 1988).

Exposures	Essi Võhandu R.	Ratta müür Võhandu R.	Joosu quarry	Vastse-Nursi Rõuge R..	Kalna Lenčupe R.	Muižaraj .Abava R.	Lējeji Abava R.
Fishes							
<i>Psammolepis abavica</i>	•	•		•	•		•
<i>Livosteus</i>				•	•		•
<i>Watsonosteus</i>	•	•	•			•	
<i>Microbrachius</i>	•		?	?			
<i>Asterolepis</i> (large form)	•	•		•	•	•	•
<i>Cheirolepis gaugeri</i>	•						
<i>Laccognathus</i>	•	•		•	?		

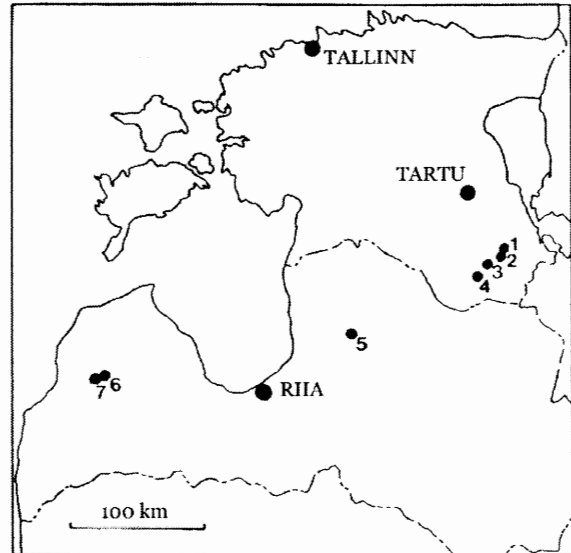


Figure 1. Fish localities of the Abava Beds in Estonia and Latvia: 1 – Essi, 2 – Ratta müür (1, 2 on Võhandu R.), 3 – Joosu, 4 – Vastse-Nursi, 5 – Kalna, Lenčupe R., 6 - Lējeji, 7 – Muižaraji (6, 7 on Abava R.); RIIA = RIGA.

Table 1. Characteristic fishes of the Middle Devonian Abava Beds from Estonia and Latvia.

One of the *Watsonosteus* finds comes from the Lithuanian Krekenava core at the depth of 122 m in the lower part of the Šventoji RS (Ivanov 1992). The lower boundary of the regional stage in this boring is established at the depth of 150.2 m, the thickness of the stage is 85.9 m (Paškevičius 1997). *Laccognathus* sp. has also identified at the depth of 137 m. In this core, as in many other Lithuanian drill cores, the Gauja and Amata formations have not distinguished in the Šventoji RS. Moreover, not distinguished are also the Abava Beds neither in the Šventoji RS nor in the underlying Butkūnai Formation of the Upninkai Beds.

In Belarus the upper, Moroch Formation of the Polotsk RS could correspond to the Abava Beds (Mark-Kurik 2000). The Moroch Fm has yielded the antiarch *Microbrachius* or a genus, very close to it, together with the paleoniscoid *Cheirolepis gaugeri* and *Laccognathus* sp. In Estonia *Microbrachius*, *Cheirolepis gaugeri* and *Laccognathus* are

known from the Abava beds. The Moroch Formation has the Givetian age (Makhnach et al. 2001). According to Sorokin (1996) equivalents of the Abava beds could occur on the Pashijsk Formation level in the northern Timan, the north-eastern part of the East European Platform. Analogs of the Abava Beds can probably find even further to the East, on Severnaya Zemlya, the Siberian Arctic archipelago (Mark-Kurik 1999b). The Gremyashchi Fm in the upper part of the Middle Devonian has yielded several remains of *Watsonosteus*.

Though the Abava Beds form in Estonia a unit of lower rank and in adjacent areas, for example, in Latvia they are not distinguished at present time (Stinkulis 1999), nevertheless, the beds are of much interest as a characteristic stratigraphical level and are significant from the aspect of the interregional correlation. Of special interest are the buccopharyngial teeth of chondrichthyans, discovered in the Abava beds. Together with teeth from jaws, the buccopharyngial teeth are known from the Viljandi Beds of the Aruküla RS (Mark-Kurik & Karatajūtė–Talimaa 2004). The Abava Beds are worth to be specially studied in the future.

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