

## Research of archaeological radiolarites in Hungary

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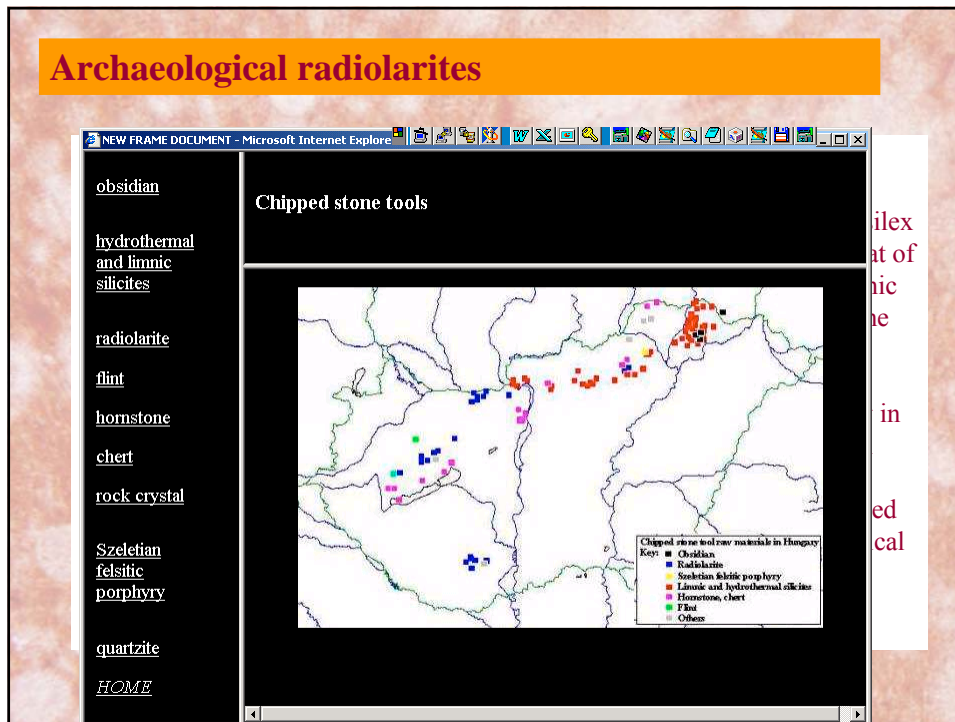
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### Radiolarites

Radiolarite belong to the group of sedimentary siliceous rocks. As the name indicates, it is formed of Radiolaria, i.e., the skeletal elements of siliceous unicellular beings. Apart from siliceous sponges and diatoms, Radiolaria are the most important biogene sources for the formation of sedimentary siliceous rocks. They are present in the seas and oceans since at least the Palaeozoic period. Radiolaria are accumulated in rock-forming quantities only among very special circumstances. For this, deep and cold water is ideal where other marine fauna is scarce and the temperature of the water prevents the accumulation of carbonic rocks. Being small in size radiolarite accumulates from radiolarian silt very slowly, by a rate of some cms per million years. The mass occurrence of Radiolaria in the present day Carpathian basin and formation of radiolarite took place in the Mesozoic period when the world ocean (Tethys) was of equatorial position. Radiolarite was formed in a long, west-eastern arch along the Alp-Carpathian system, across the Balkans till the Himalayas. The resulting siliceous rocks can be found at many places in south-central Europe. On the basis of physical qualities, mainly colour, lustre and character of bedrock, regionally meaningful macroscopic groups could be differentiated among radiolarites. These groups are currently investigated by detailed chemical studies to check the validity of these categories and provide objective means for distribution studies.

## Archaeological radiolarites



## Archaeological radiolarites

### Macroscopically separable:

#### Transdanubian radiolarite

- Szentgál type (red)
- Urkút-Eplény type (mustard yellow)
- Hárskút type (brown with orange shade)
- Tata type (liver-coloured)
- Transdanubian radiolarite, reddish brown
- Sümeg radiolarian flint - bluish grey
- Gerecse - reddish grey
- Transdanubian radiolarite, other

## Archaeological radiolarites

### Mecsek radiolarite

- Mecsek radiolarite - lilac, dark red
- Mecsek radiolarite - grey - bluish grey, silky lustre
- Mecsek radiolarite - other

### Carpathian radiolarite

- Carpathian radiolarite - "blue silex"
- Carpathian radiolarite - dark red with marbly pattern
- Carpathian radiolarite - dark brownish red
- Carpathian radiolarite - grey
- Carpathian radiolarite - other

### Bükk radiolarite

### Other radiolarite

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## Macroscopically separable types

Szentgál radiolarite, Lengyel LN



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## Macroscopically separable types

Úrkút-Eplény radiolarite, Lengyel LN



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## Macroscopically separable types

Mecsek dark red radiolarite, Lengyel LN



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## Macroscopically separable types

Mecsek grey radiolarite, Lengyel LN



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## Macroscopically separable types

Carpathian greenish grey radiolarite, Jászfelsőszentgyörgy UP



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## Macroscopically separable types

Croatian radiolarites - Slavonski Brod, EN



## Macroscopically separable types

Croatian radiolarites - Otok, MN

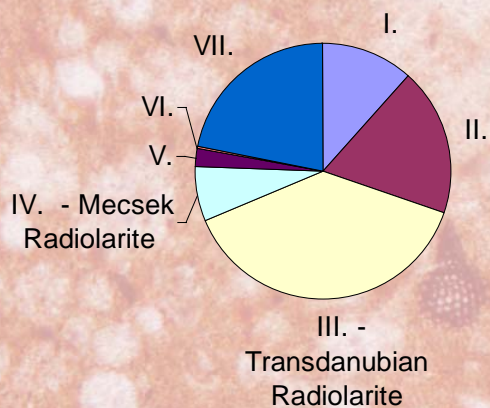


## Macroscopically separable types

Croatian radiolarites - Otok, MN

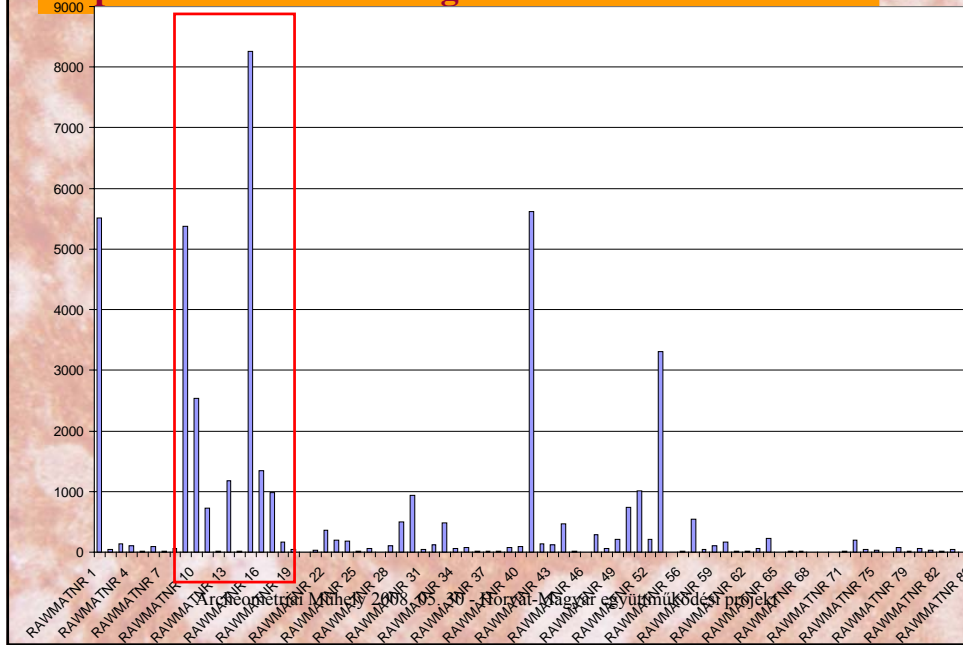


## Importance of archaeological radiolarites



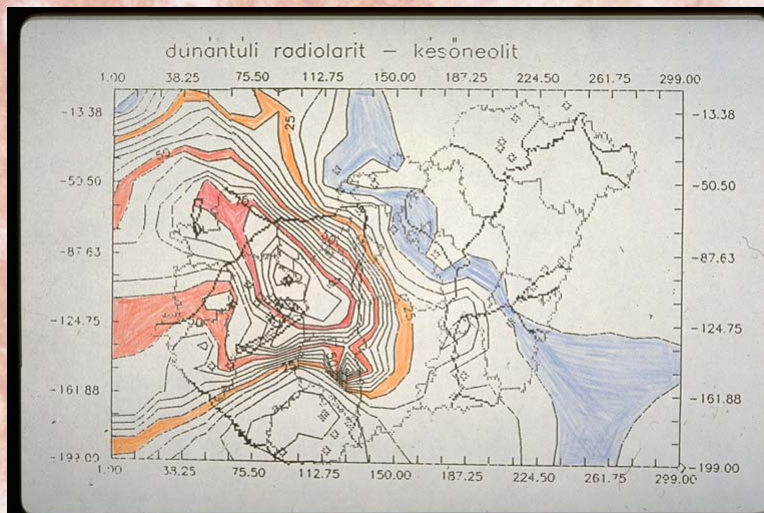
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## Importance of archaeological radiolarites



## Distribution of macroscopically separable types

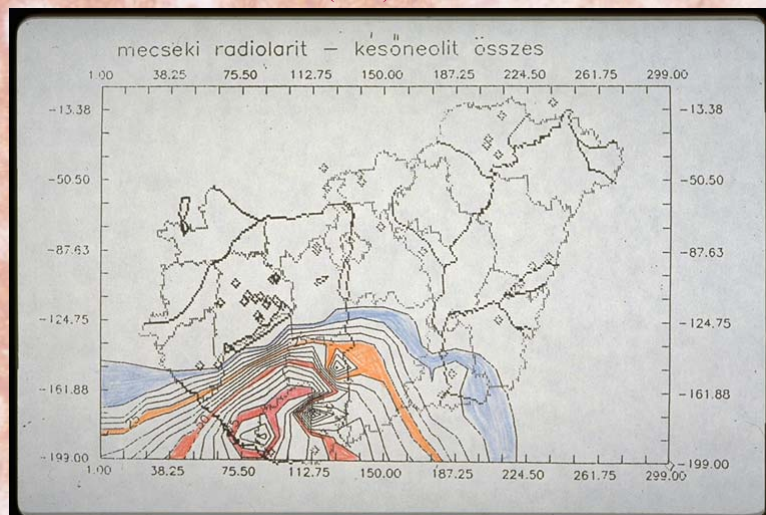
LN Distribution of Transdanubian radiolarite (1992)





## Distribution of macroscopically separable types

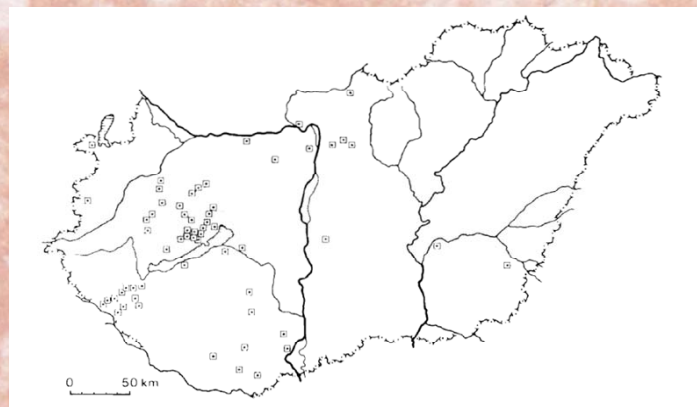
LN Distribution of Mecsek radiolarite (1992)



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## Distribution of macroscopically separable types

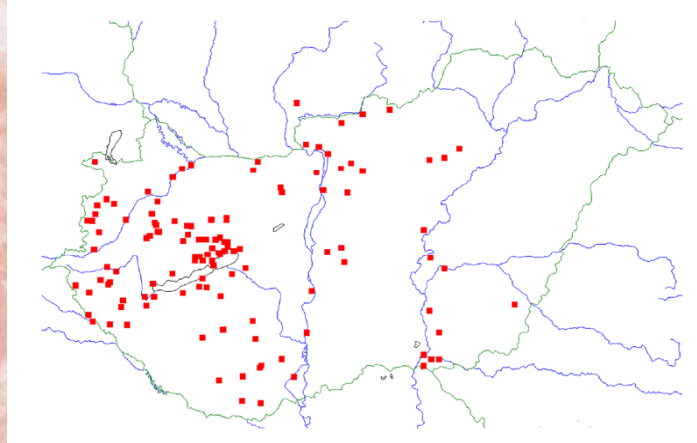
Distribution of Szentgál radiolarite (1988)



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## Distribution of macroscopically separable types

Distribution of Szentgál radiolarite (2008)



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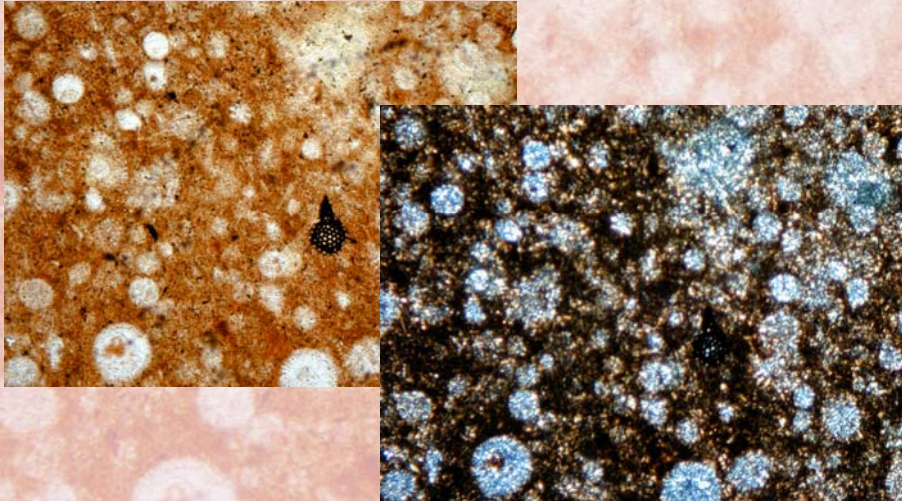
## Analytical achievements

- ◆ Petrographic thin section (TS)
- ◆ X-ray diffraction (XRD)
- ◆ Obszidián hidratációs korhatározás (OHD)
- ◆ Electron- and X-ray spectroscopy (EDS, XRF)
- ◆ Fluid zárvány vizsgálatok (FIA)
- ◆ Neutron activation analysis (NAA)
- ◆ Proton-induced X-ray and  $\gamma$ -ray spectroscopy (PIXE-PIGE)
- ◆ Hasadási nyomvonal detektálás (FTD)
- ◆ Prompt-gamma activation analysis (PGA)
- ◆ Elektron mikropróba vizsgálat (EMPA)

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## Analytical achievements

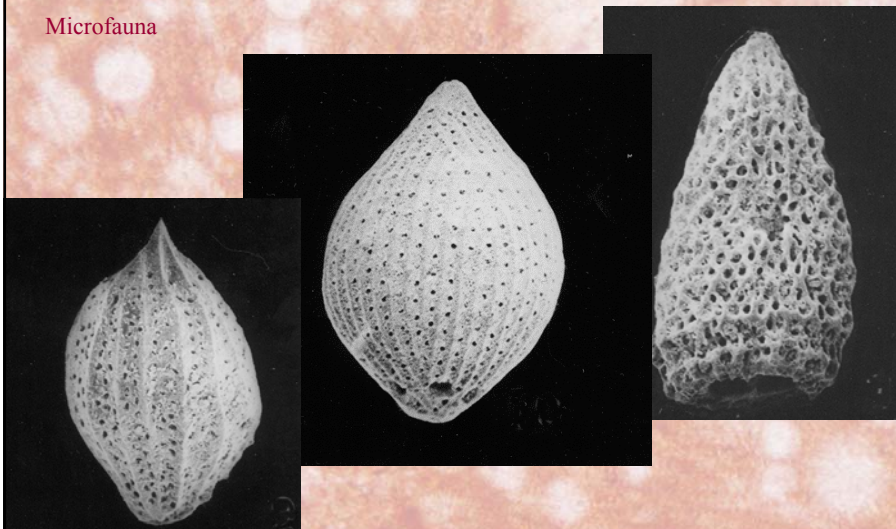
Petrographical thin section



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## Analytical achievements

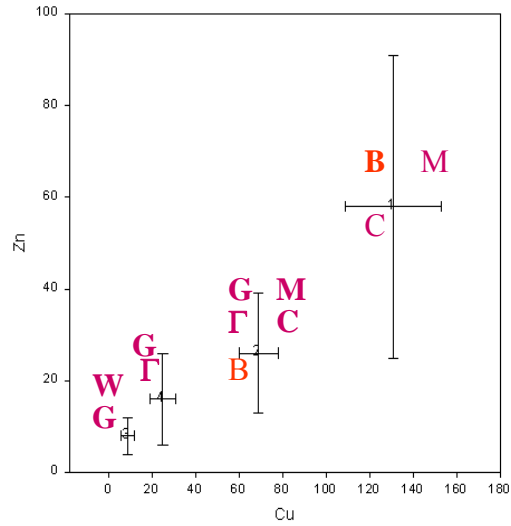
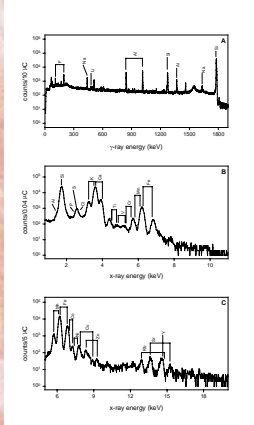
Microfauna



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## Analytical achievements

### Chemical characterisation

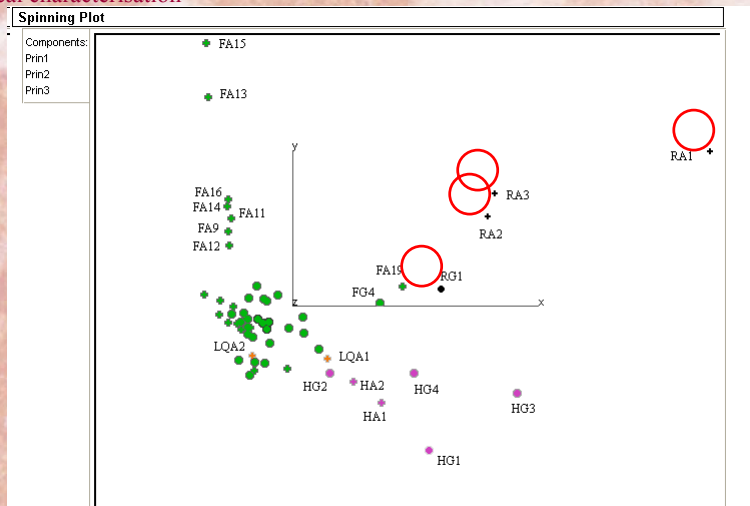


PIXE-PIGE, Elekes et al. 2000 (NIM)

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## Analytical achievements

### Chemical characterisation



PGAA, Spin-plot on PCA, Kasztovszky-Biró Quebec in press

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## Conclusions

- Radiolarites are one of the most important elements of the lithic inventory in the Carpathian Basin
- They can be easily differentiated from other siliceous raw materials on the basis of the presence of microfossils *Radiolaria*
- Colour varieties are diagnostic but not unquestionable

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