

Histological and analytics studies on the formation and composition of the incremental lines of rat dentin by melatonin medication

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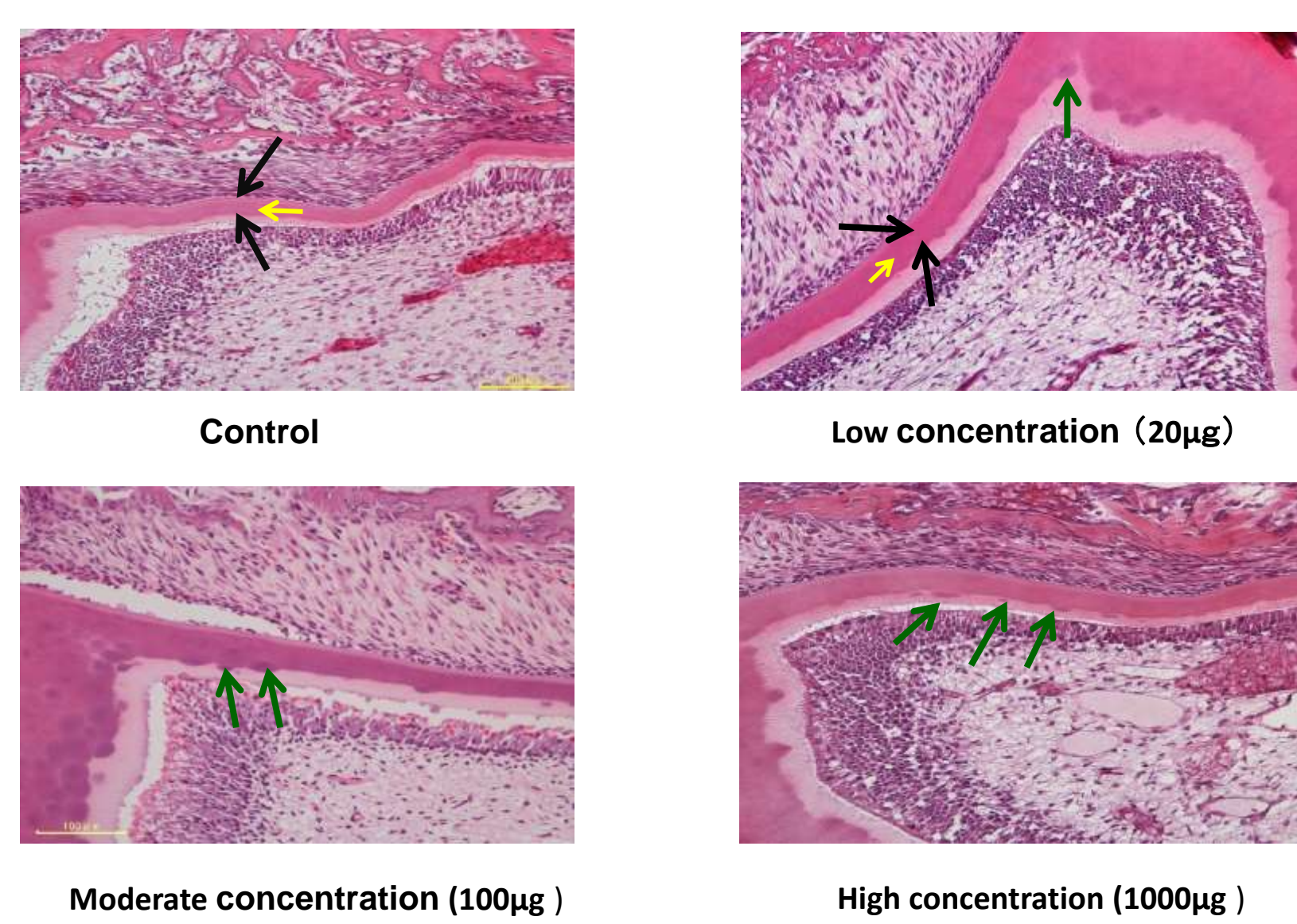
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Purpose, Material and Methods

The purpose of the present study is to examine the relationship between the formation and composition of incremental lines in tooth dentin and the role of melatonin by histological and analytics studies.

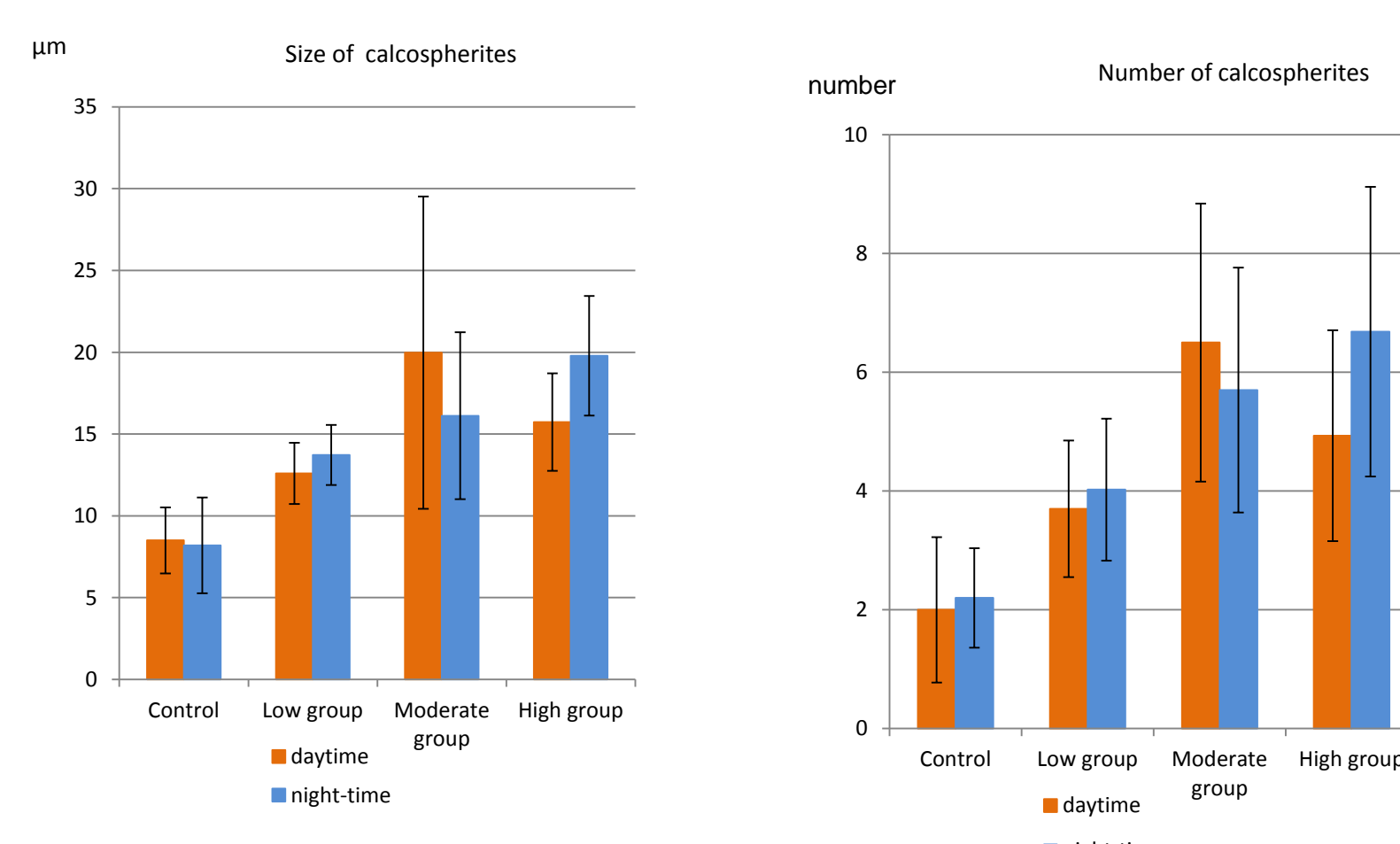
In this experiment, 5, 6, and 7 day old SD rats were used. These rats were divided into four groups: 1) a control group (0.5% alcohol content drinking water); 2) a low concentration group (0.5% alcohol + 20µg/ml melatonin content drinking water); 3) a moderate concentration group (0.5% alcohol + 100µg/ml melatonin content drinking water); 4) a high concentration group (0.5% alcohol + 1000µg/ml melatonin content drinking water). The animal protocol was approved by the Animal Care and Use Committee of Meikai University. The specimens were observed and analyzed using a light microscopy, a scanning electron microscopy (SEM), a SEM-EDS analysis, a laser Raman microprobe spectrometry, and an electron-probe microanalyzer (EPMA). Staining: HE staining, azan staining and alkaline phosphatase (ALP) staining.

5 days old, daytime, decalcification specimens, HE staining, incisor



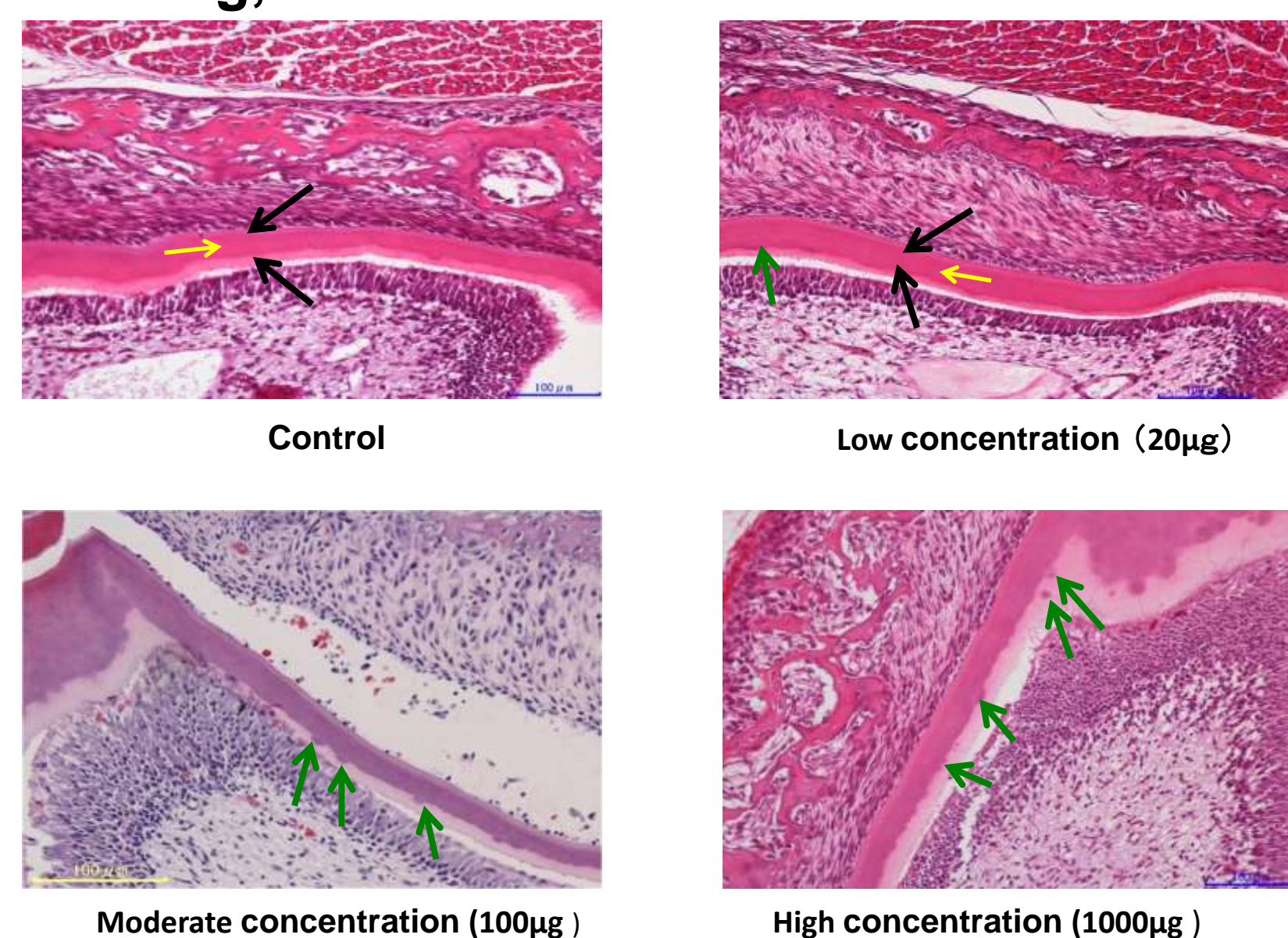
Black arrows: dark-staining incremental lines, yellow arrows: light staining layer, green arrows: calcospherites.

Number and size of calcospherites



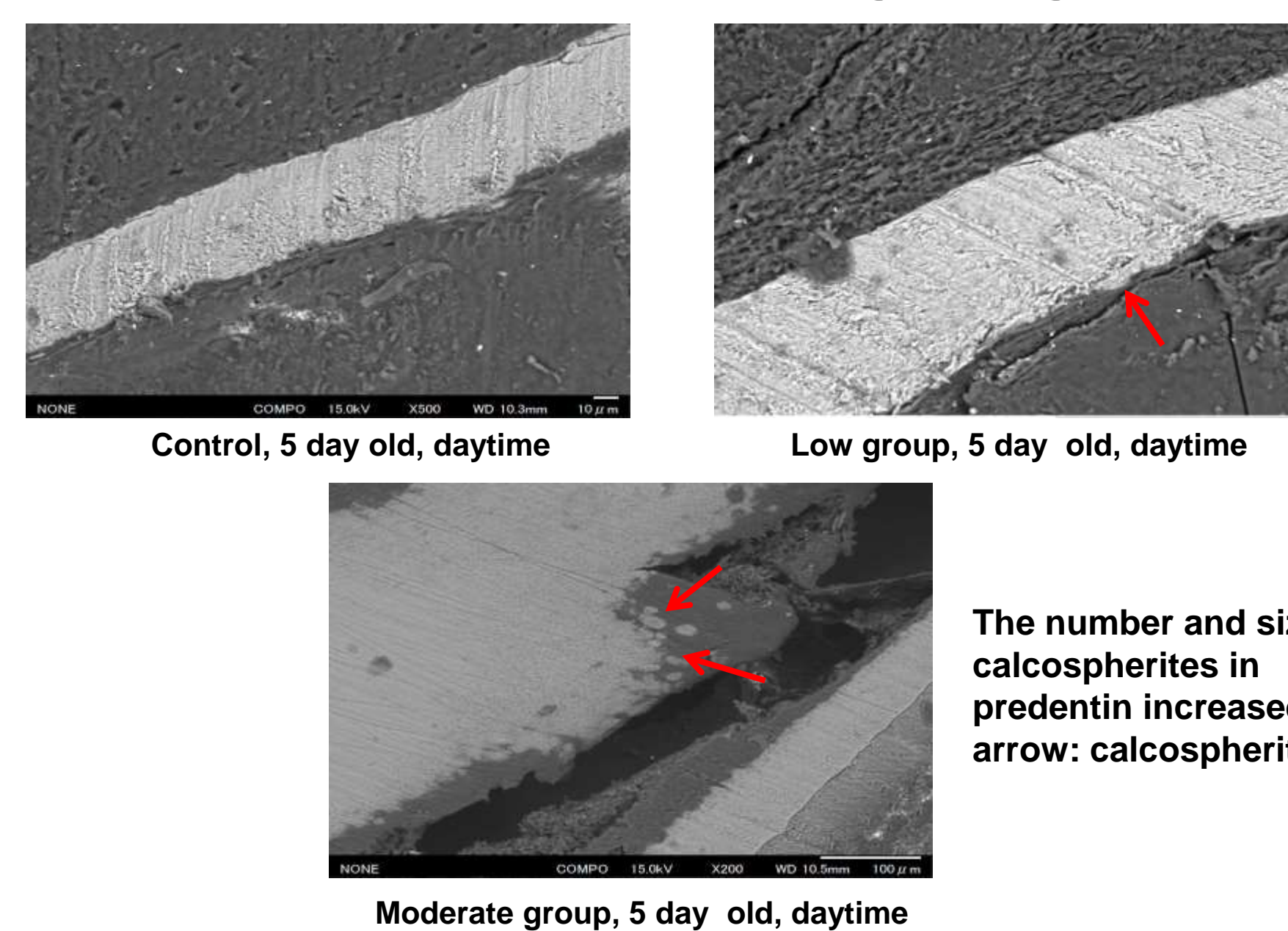
Calcospherites in predentin were measured on specimens of the HE staining.

6 days old, night-time, decalcification specimens, HE staining, incisor



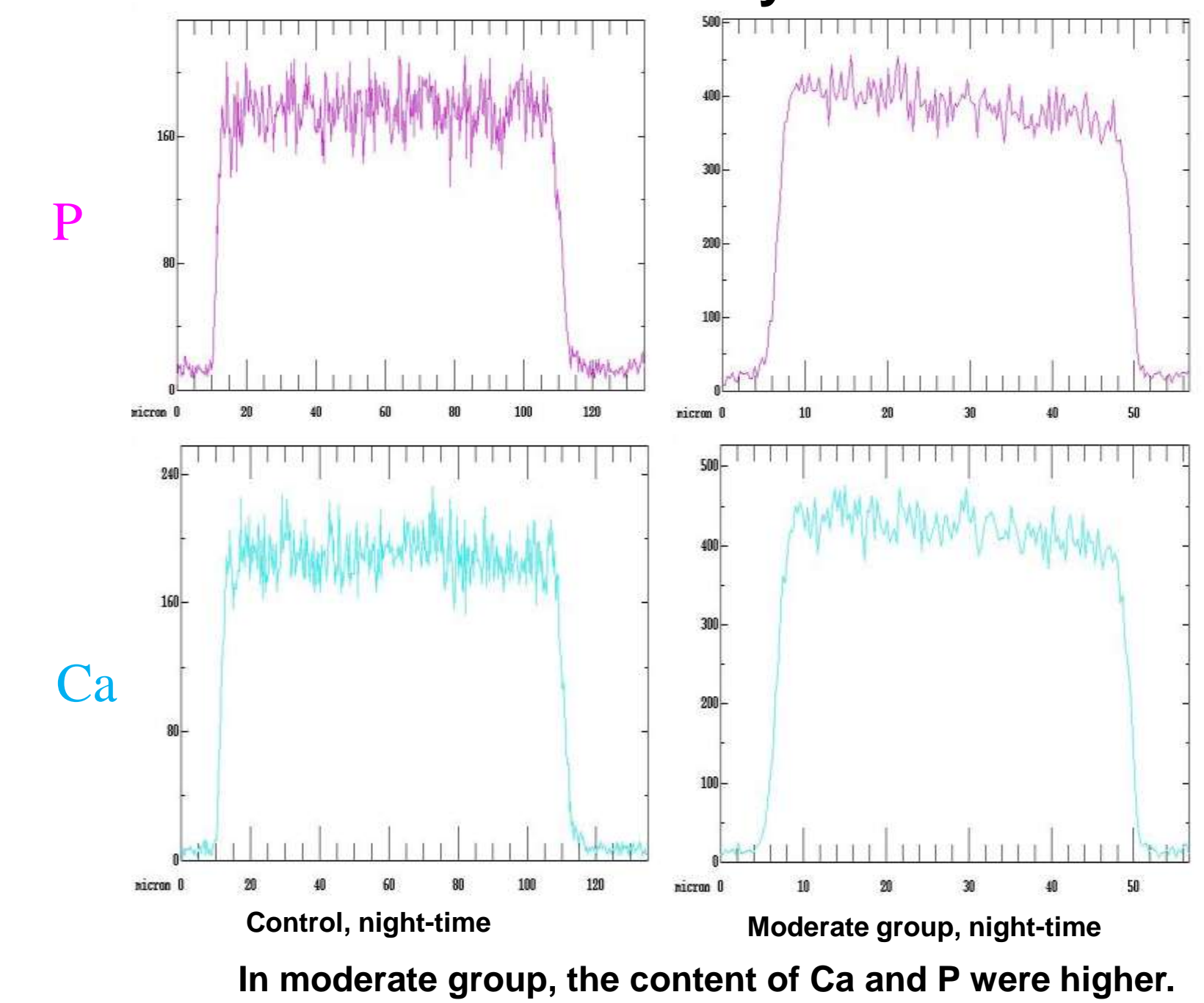
The number and size of calcospherites in predentin increased.

SEM: backscattered electron images of ground sections



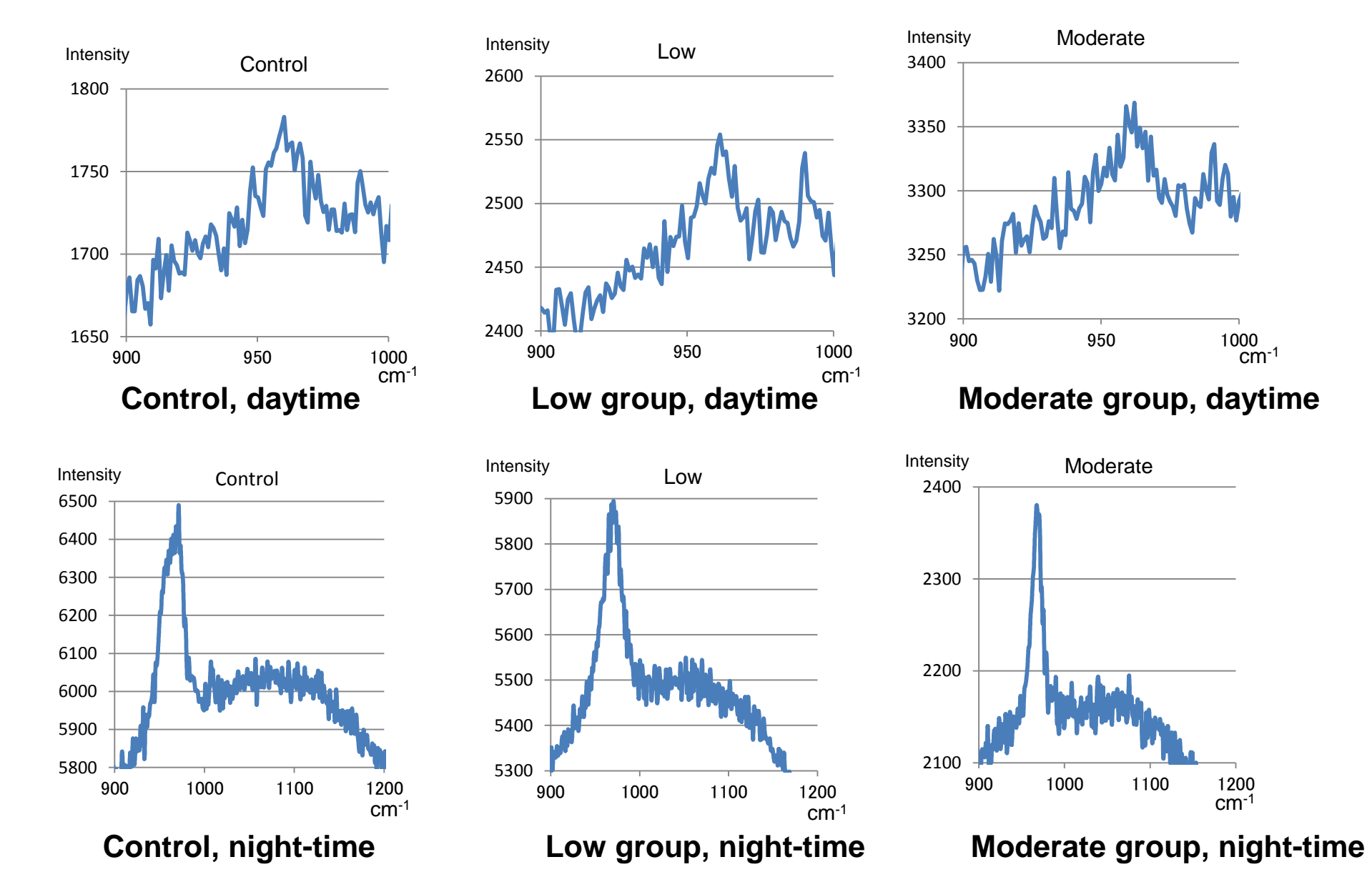
The number and size of calcospherites in predentin increased. Red arrow: calcospherites

EPMA analysis



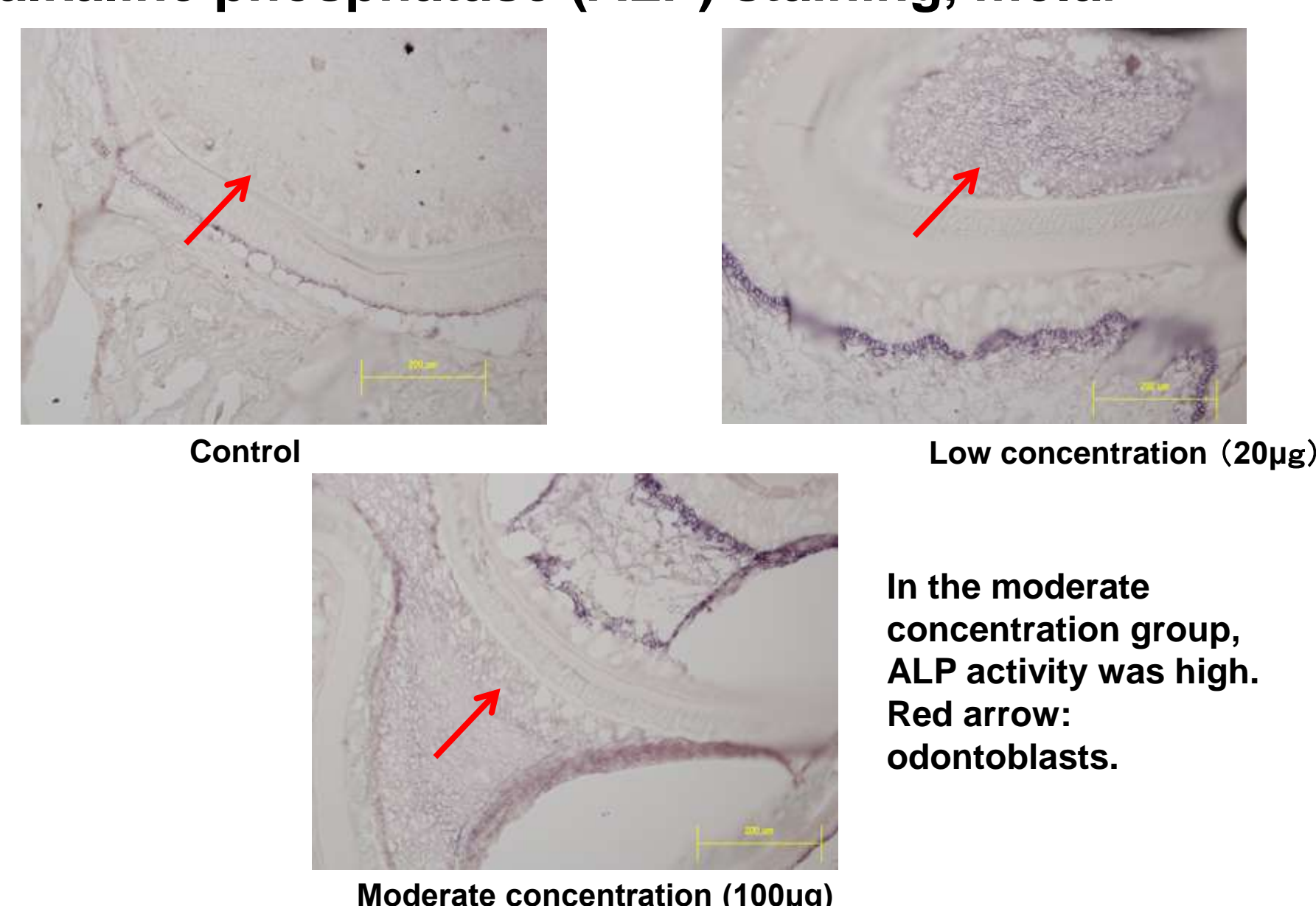
In moderate group, the content of Ca and P were higher.

Results of laser Raman microprobe spectrometry (Peak variation of the phosphate group PO₄³⁻)



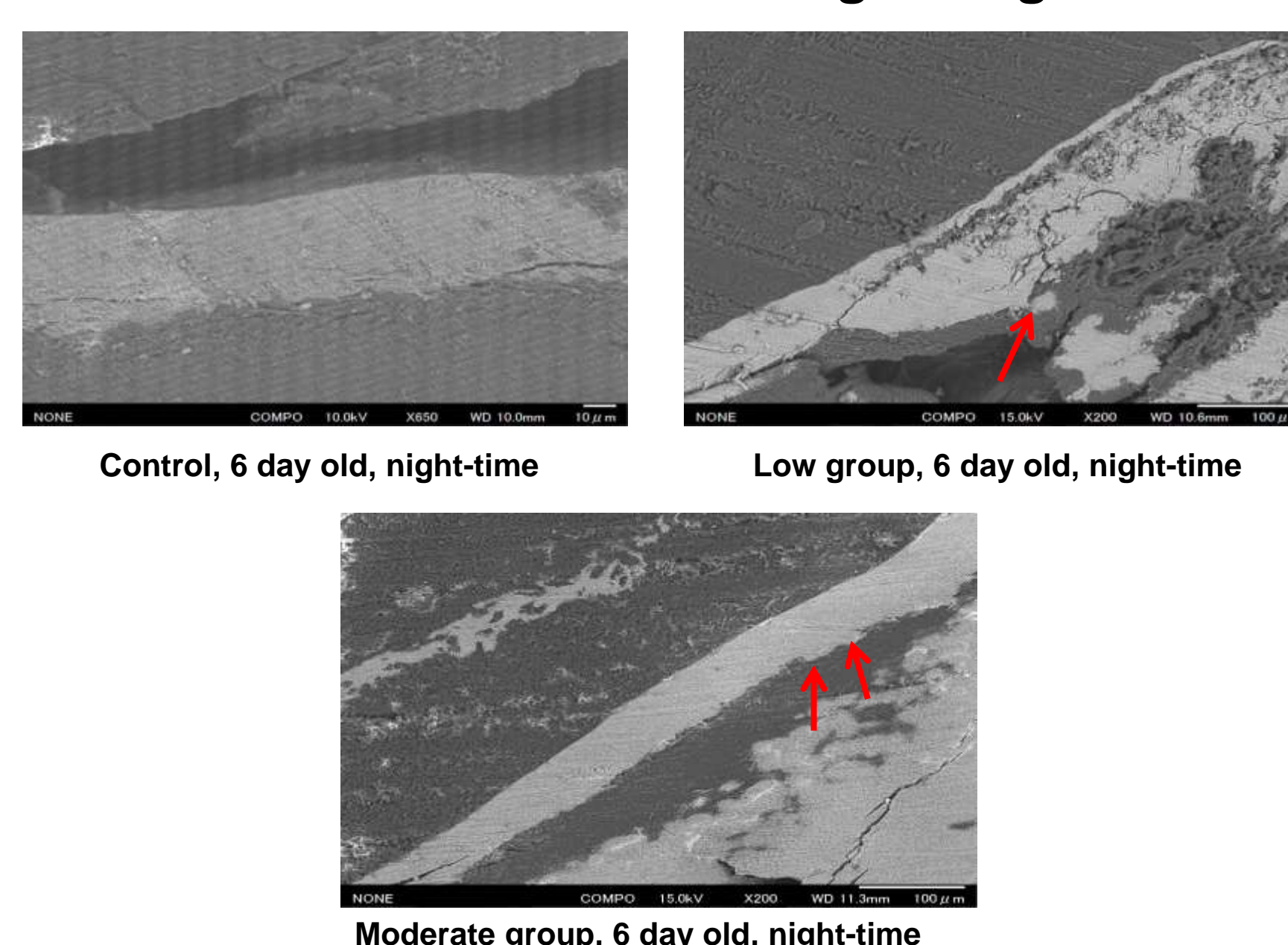
In the melatonin treated groups, the full widths of half maximum intensity were narrower.

7 days old, night-time, decalcification frozen specimens, alkaline phosphatase (ALP) staining, molar



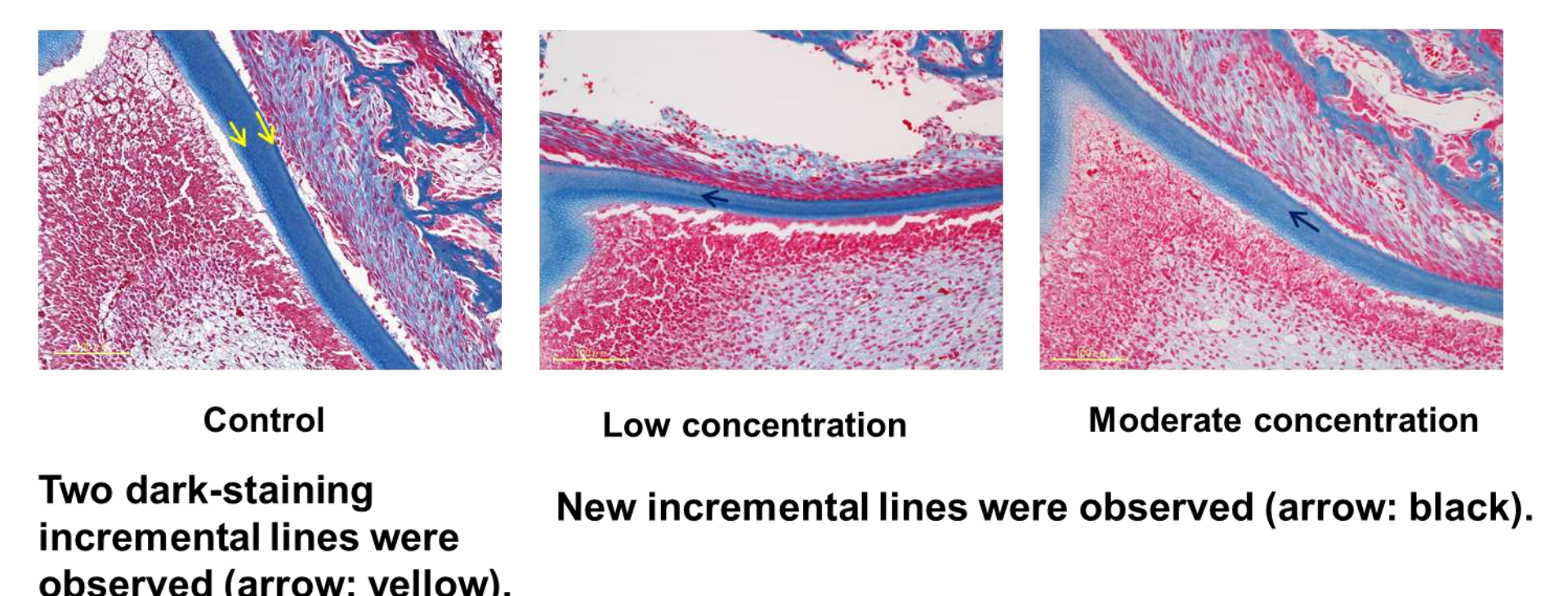
In the moderate concentration group, ALP activity was high. Red arrow: odontoblasts.

SEM: backscattered electron images of ground sections



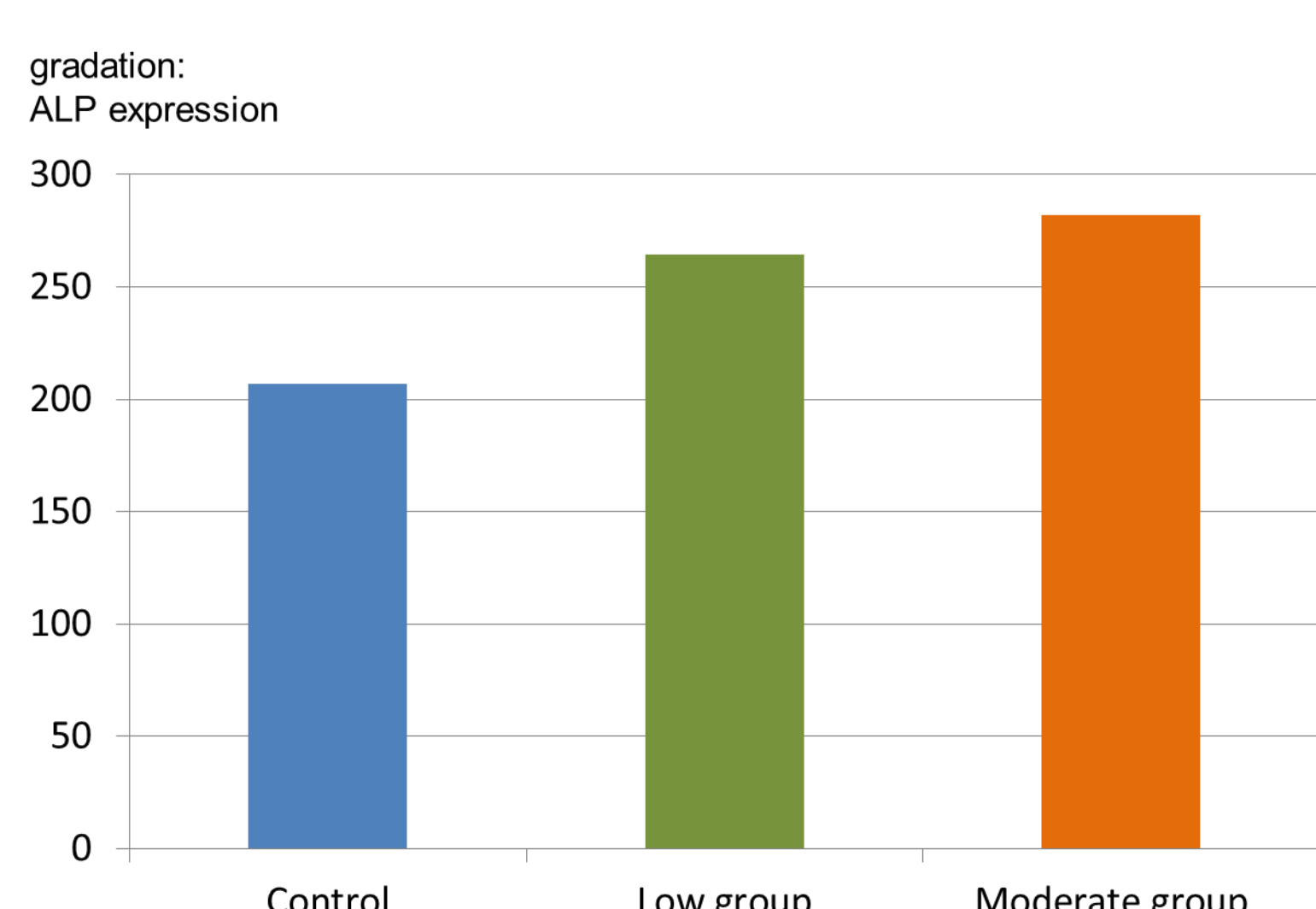
Moderate group, 6 day old, night-time

5 day old, night-time, Azan staining, incisor

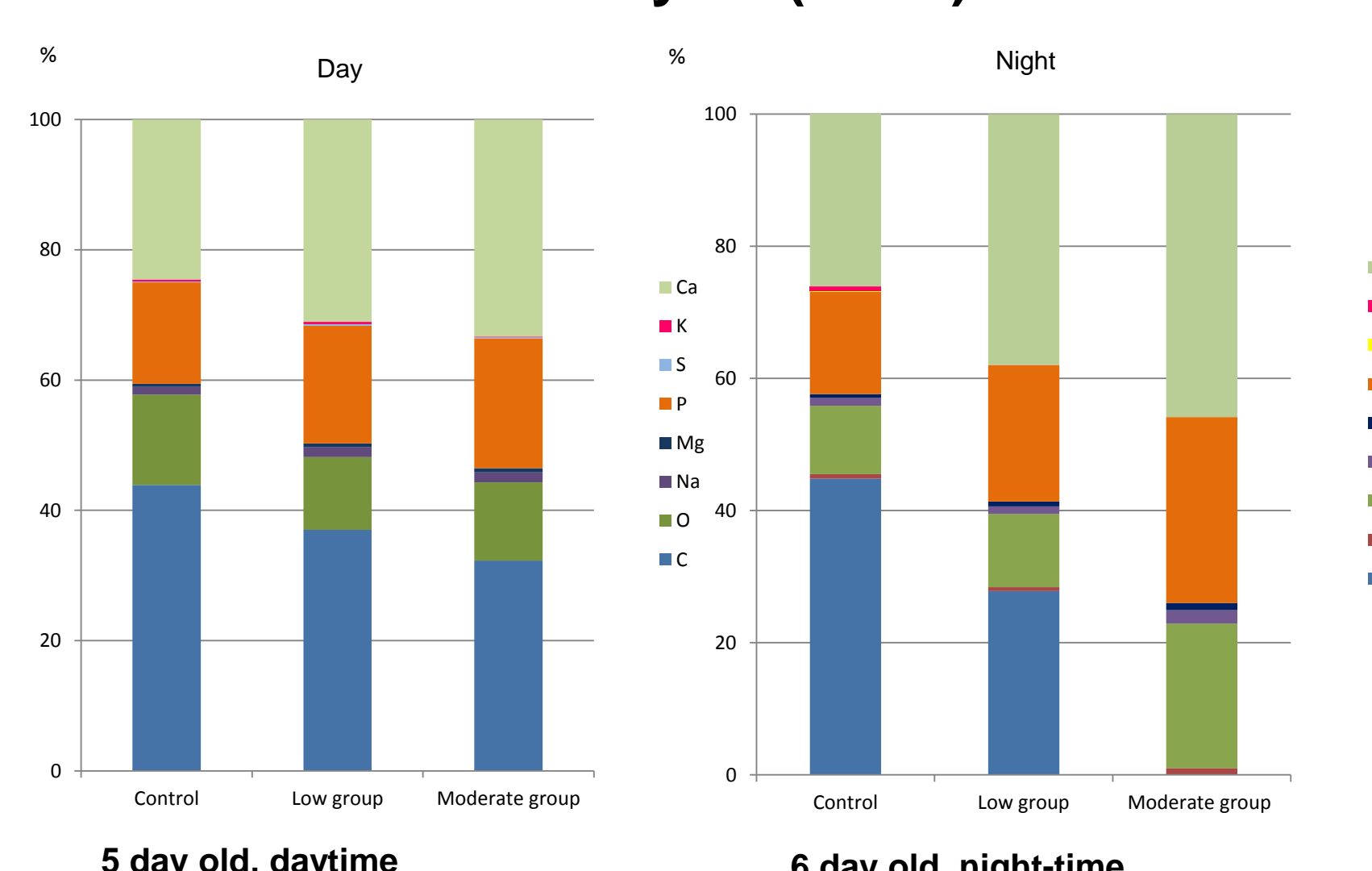


Two dark-staining incremental lines were observed (arrow: yellow). New incremental lines were observed (arrow: black).

Expression changes of ALP activity (average)

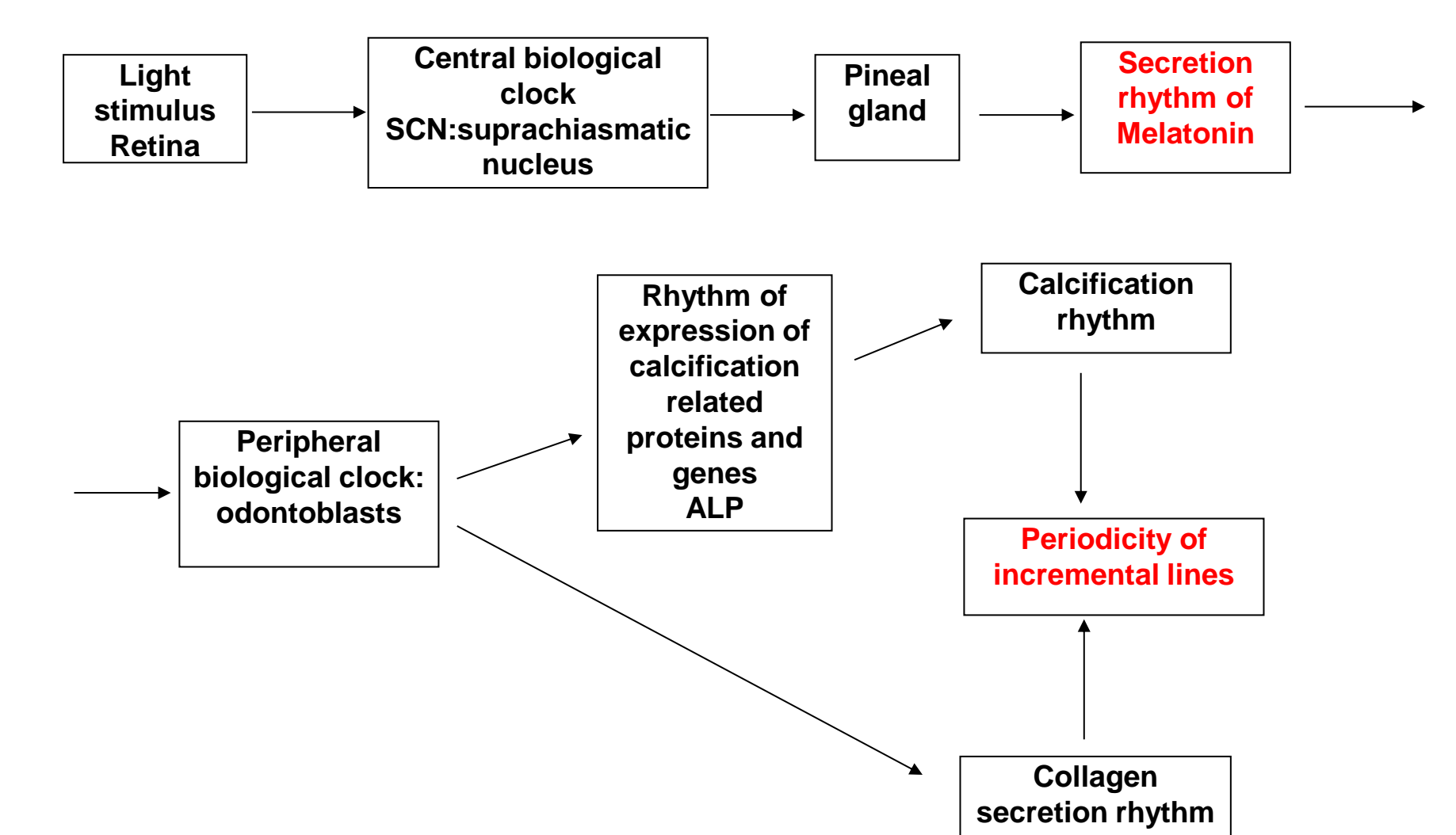


SEM-EDS analysis (Wt.%)



Ca and P content increased in the melatonin treated groups.

Periodicity of Incremental Lines in Dentin



It is suggested that melatonin may participate in the periodicity of the incremental lines of dentin.

Acknowledgment

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