

OABS scoring - training

BMLs

OA known as “disease of the cartilage”

Cartilage -> aneural and avascular structure, other factors must contribute to pain.

Microarray analysis on BML tissue found a no. of upregulated genes involved in neurogenesis, chondrogenesis, and inflammation (1)

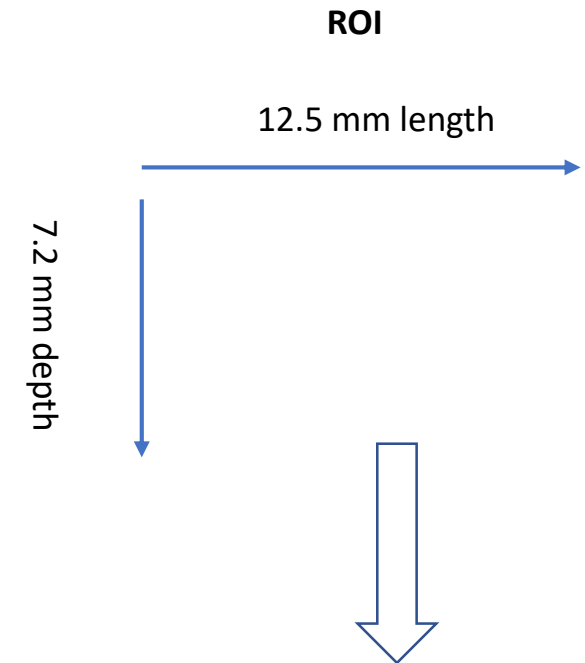
BMLs are already well described in the literature by MRI and have been associated with pain (2), but little is known about their histological changes.

AIM: to develop a novel histological scoring system to describe BMLs by comparing BML tissue versus non-BML OA tissue and normal bone.

1) Kuttapitiya A, Assi L, Laing K, Hing C, Mitchell P, Whitley G, Harrison A, Howe FA, Ejindu V, Heron C, Sofat N. Annals Rheumatic Diseases, 2017; 76(10):1764-1773

2) Hunter, D.J., Guermazi, A., Lo, G.H., Grainger, A.J., Conaghan, P.G., Boudreau, R.M. and Roemer, F.W. (2011). Evolution of semi-quantitative whole joint assessment of knee OA: MOAKS (MRI Osteoarthritis Knee Score). Osteoarthritis and Cartilage, 19(8), pp.990–1002.

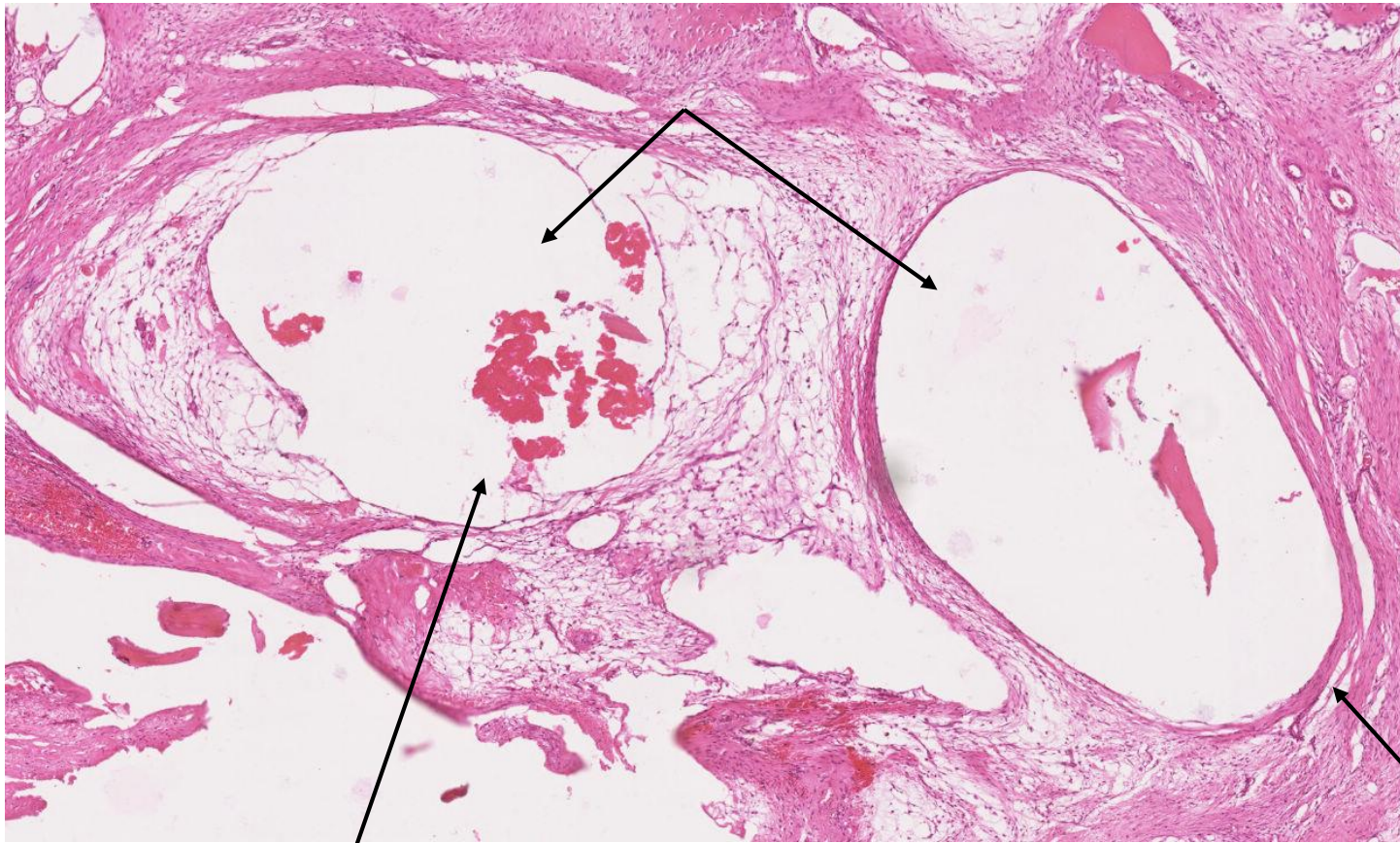
Bone Marrow Lesion Score BML-Score	Grade
I. Cysts	
None	0
Present (at least 1)	1
II. Fibrosis (thickened fibrotic connective tissue)	
None	0
Present (at least 1 region)	1
III. Blood vessels (no of BVs)	
Normal (0-15)	0
Increased (> 16)	1
IV. Cartilage (new cartilage formation within bone)	
a. Absent	0
b. Present	1
V. Trabeculae % thickened	
a. Normal (no change)	0
b. Increased thickness	1
VI. Tidemark Integrity	
a. Intact	0
b. Crossed by blood vessels	1
VII. Inflammation (cellular infiltrates)	
a. Absent	0
b. Present	1
Total	7



ROI was calculated by taking the MEAN length and depth of all tissues.

Domain 1

CYST

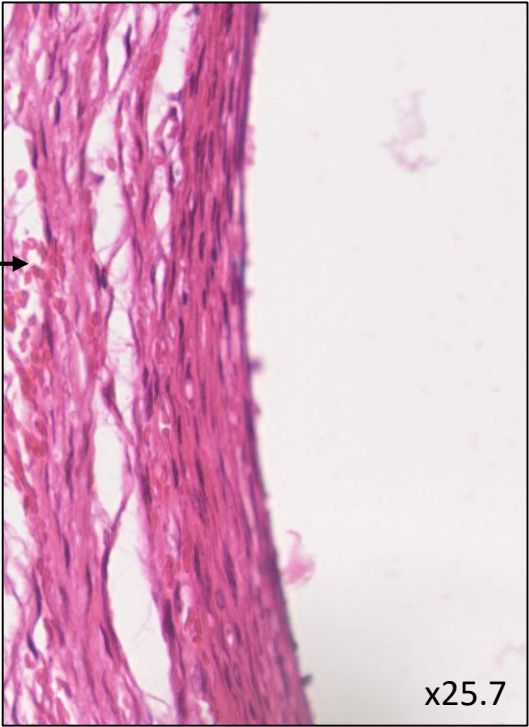
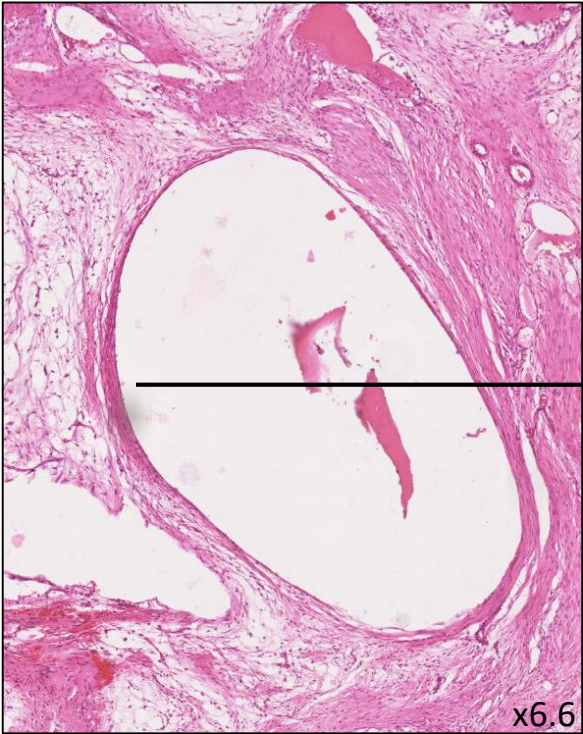
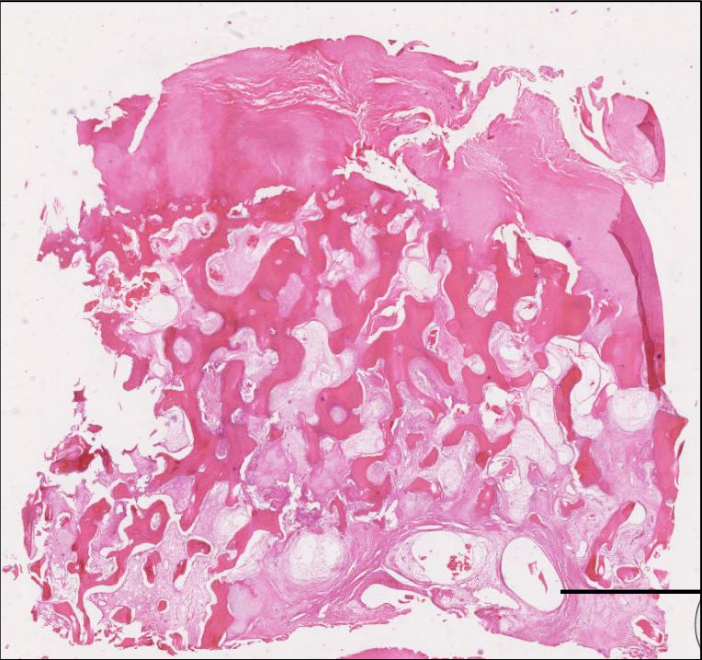


Debris

Thin fibrous wall

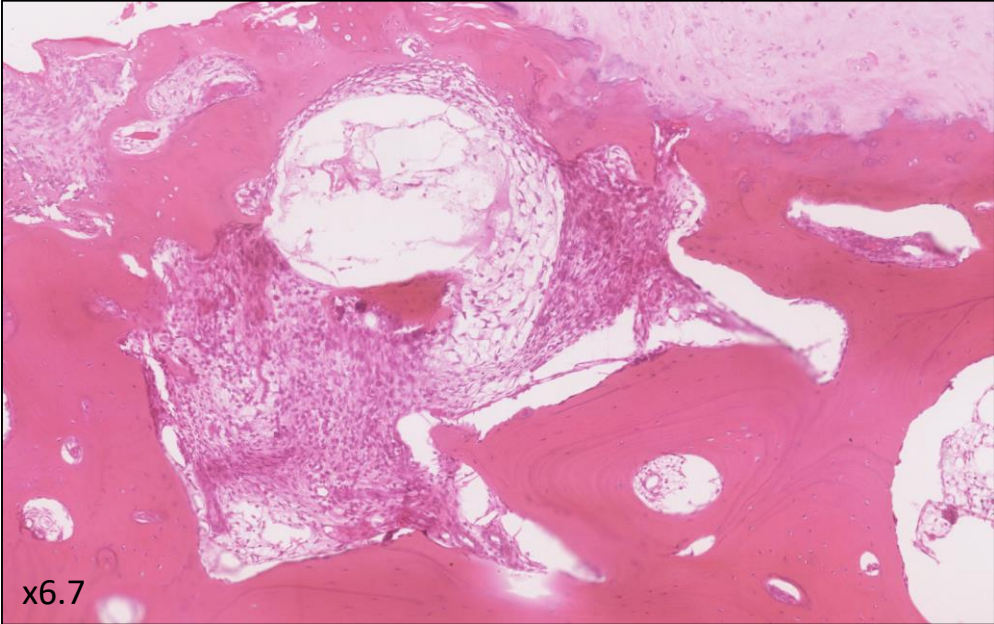
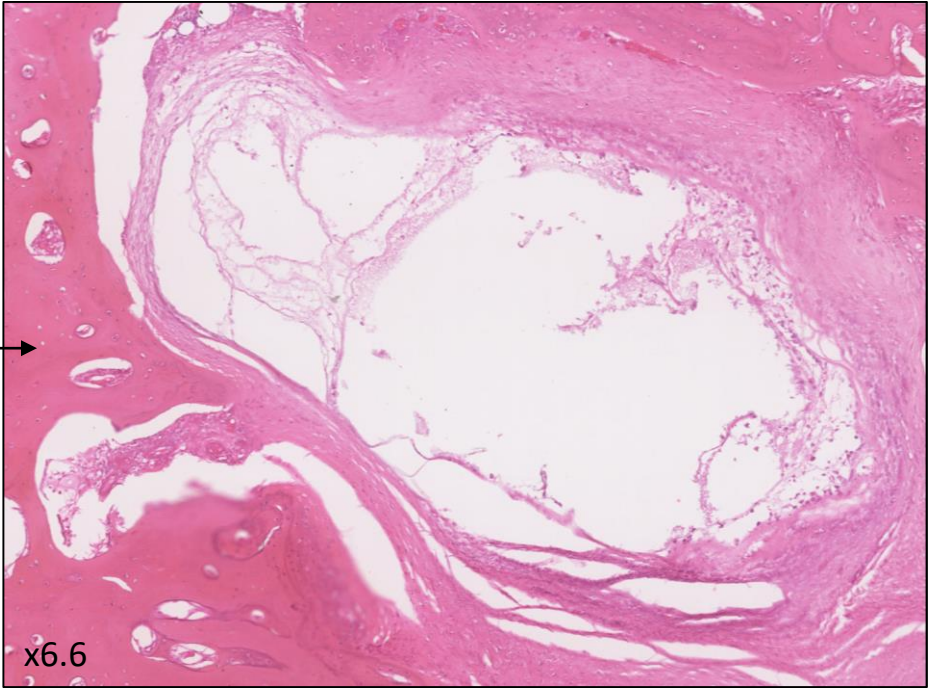
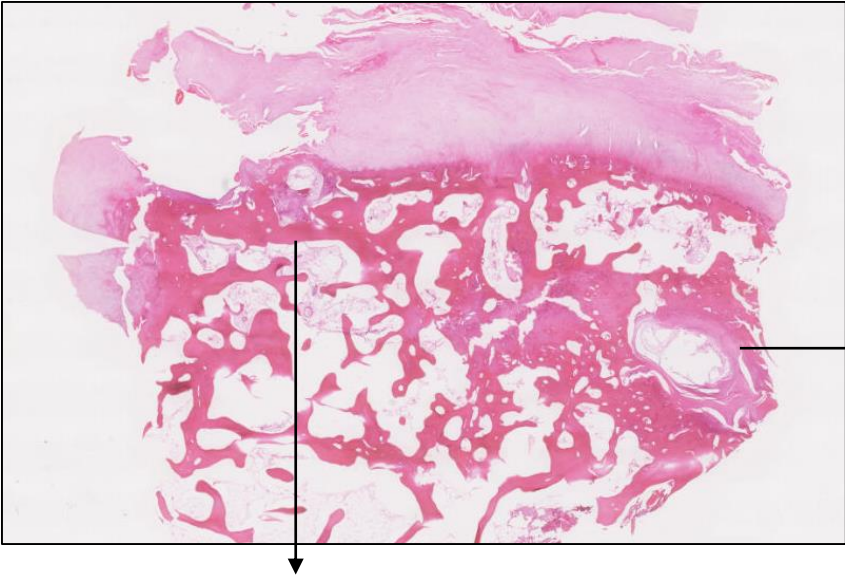
- Round structure with a thin fibrous wall
- Bony spicules replaced by fibrous tissue
- Cyst lining contains flattened fibroblasts
- Occasionally can contain debris

Example of cysts



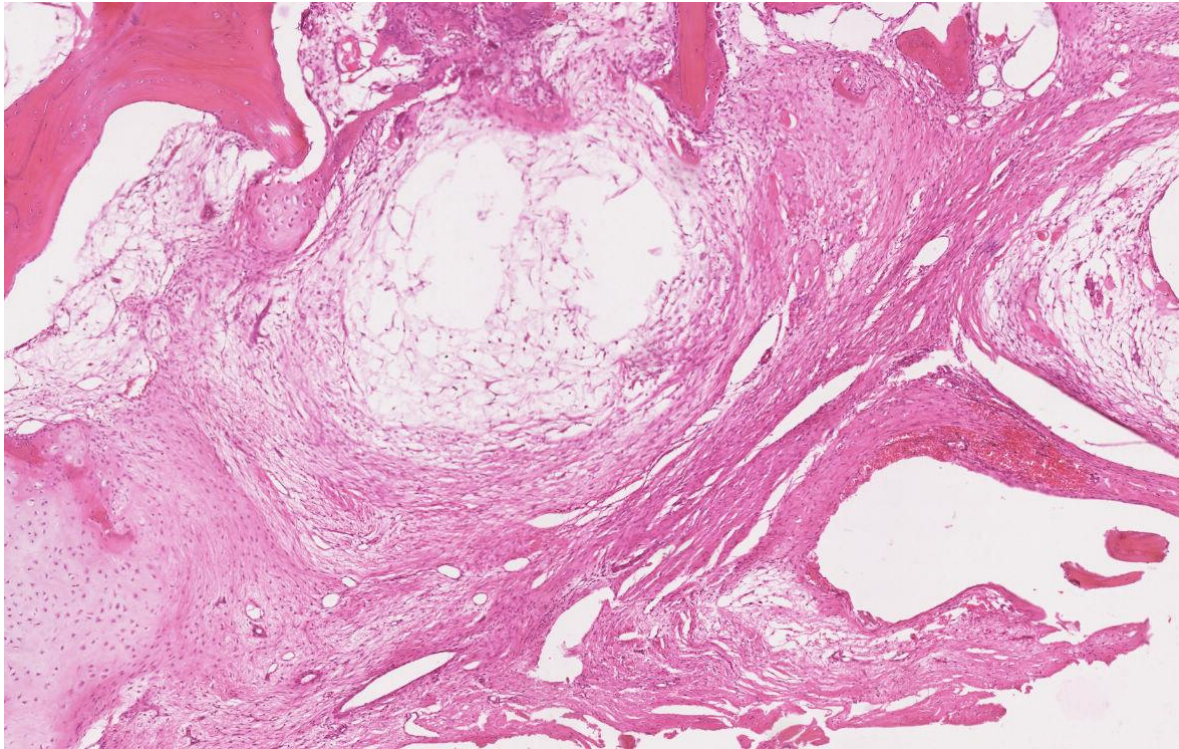
Flattened fibroblasts
around lining

Example of cysts



Domain 2

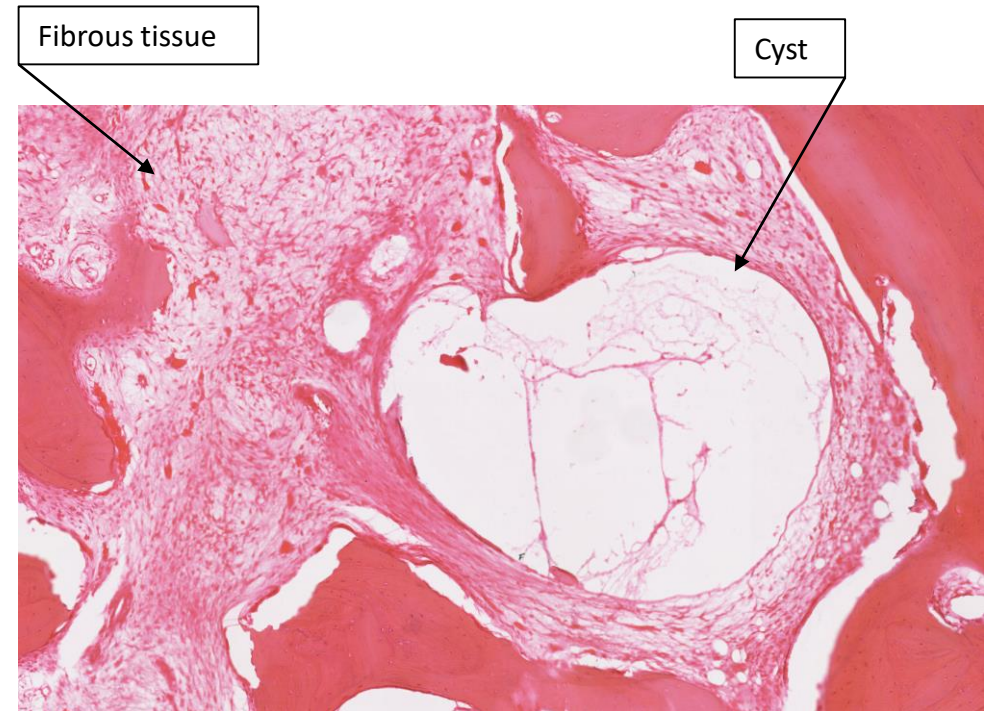
FIBROSIS



Intensively stained by eosin due to connective tissue fibers.

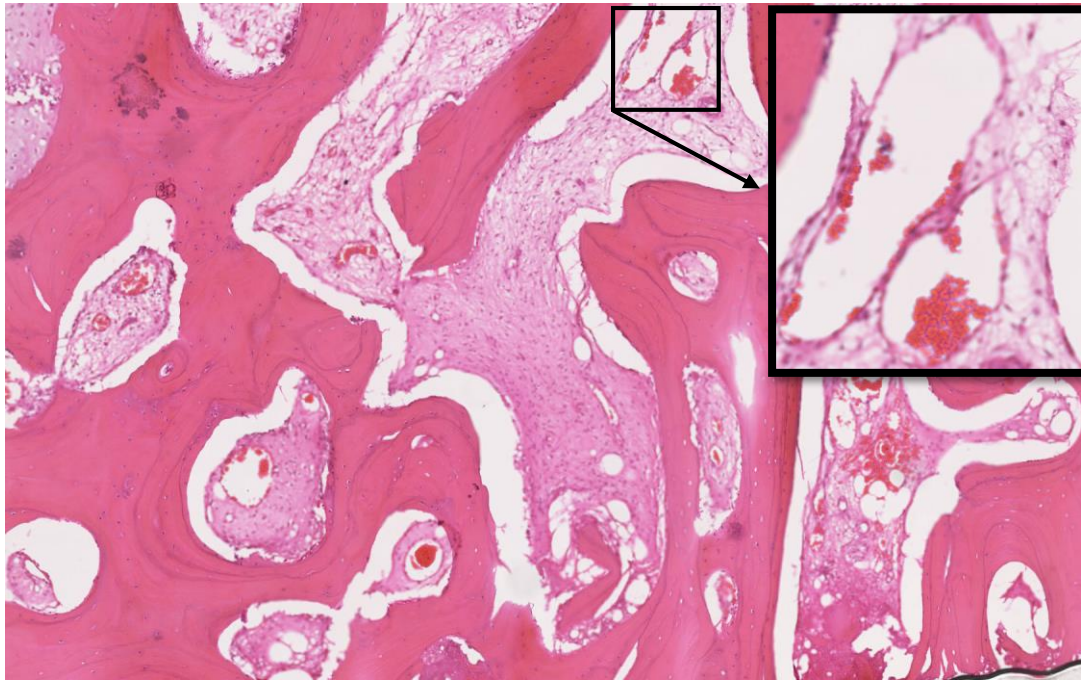
Adipose tissue partially replaced with fibrotic tissue

Sometimes found adjacent the cystic regions



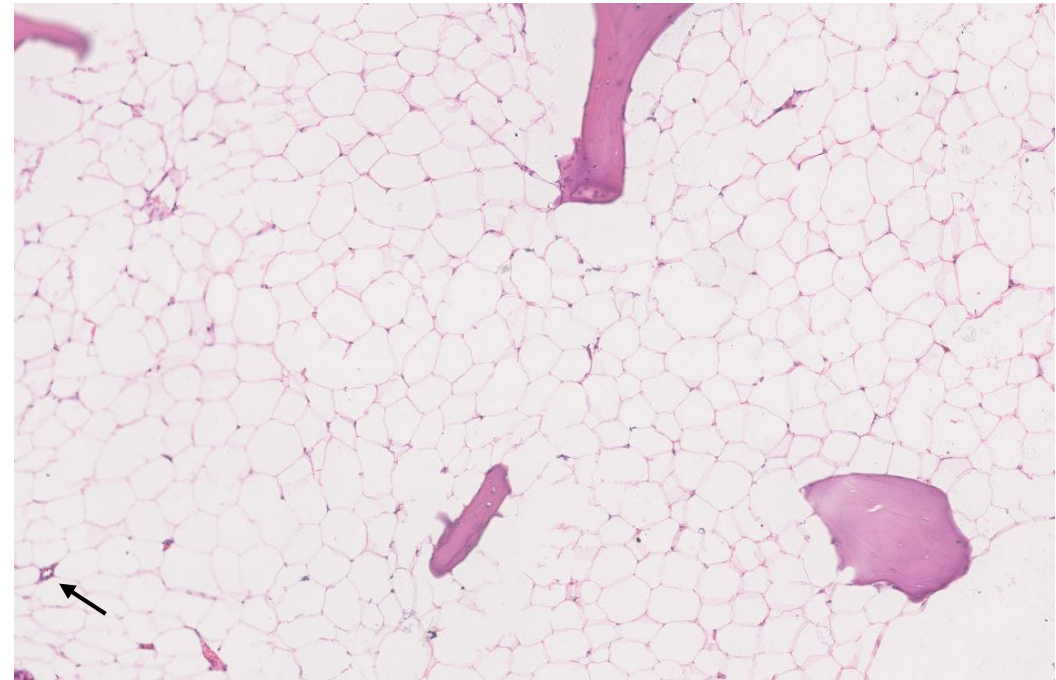
Domain 3

BLOOD VESSELS



ABNORMAL

Angiogenesis, increased number of blood vessels (>16)



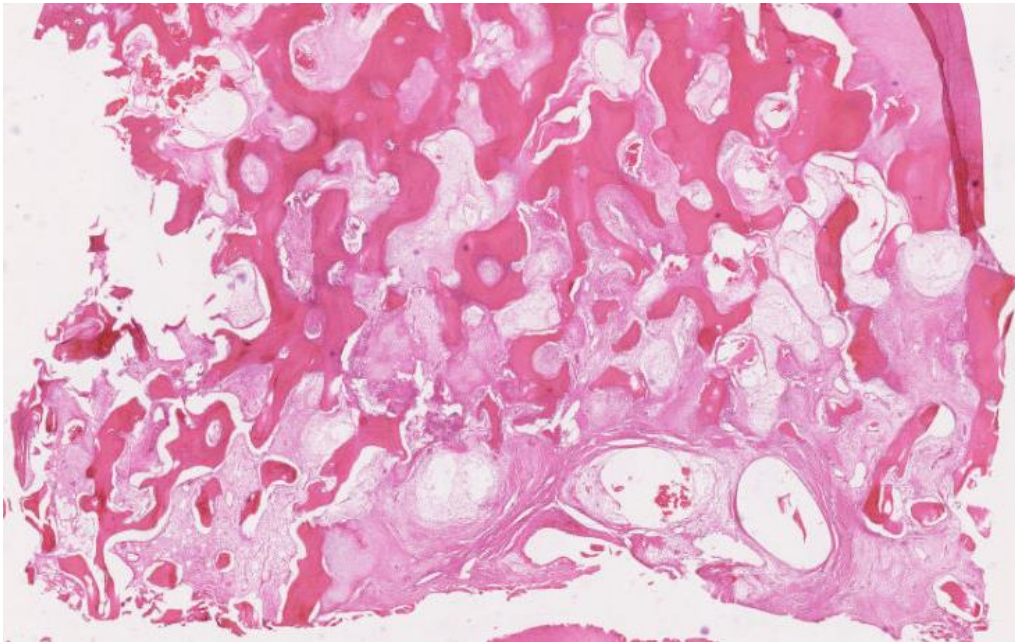
NORMAL

Blood vessels no: 0-15

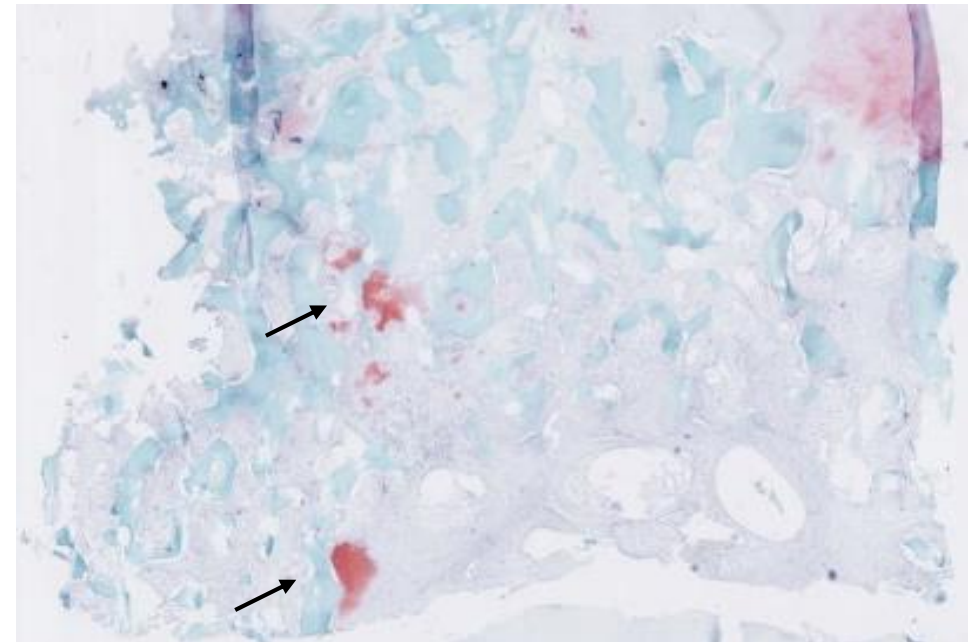
Domain 4

DE NOVO CARTILAGE (new cartilage formation)

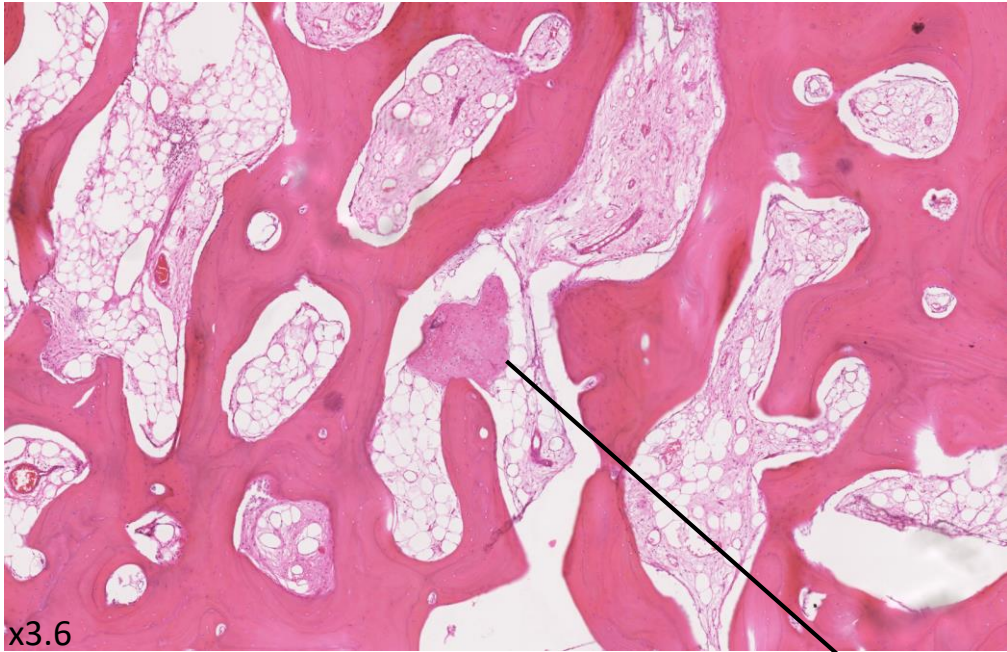
H&E



Safranin-O Fast green

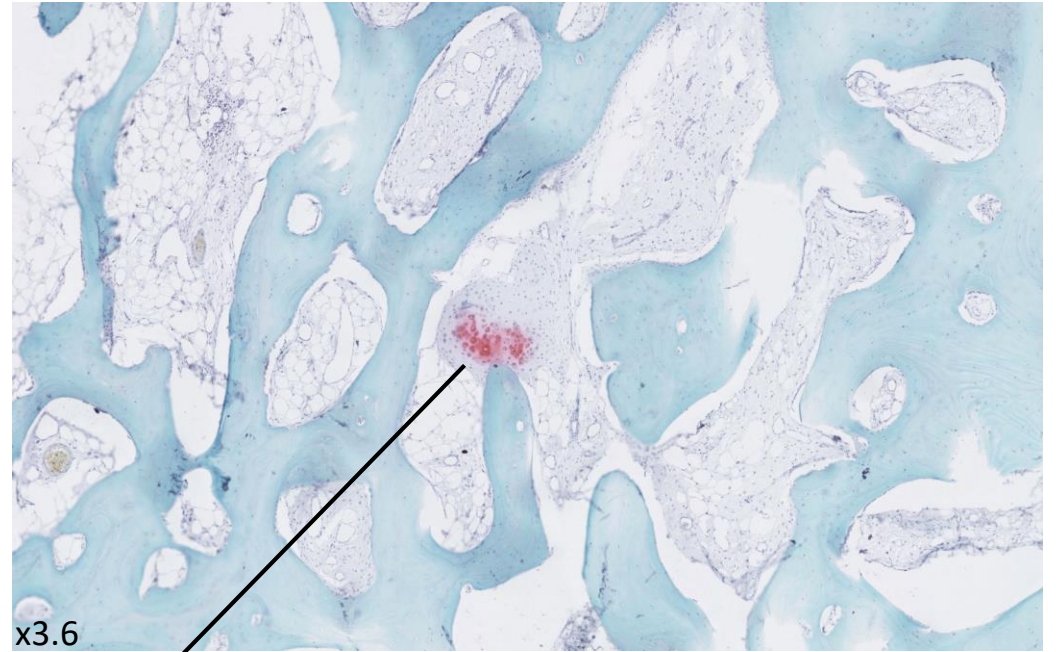


- Presence of new cartilage formation deep in the bone.
- Safranin-O fast green staining required.



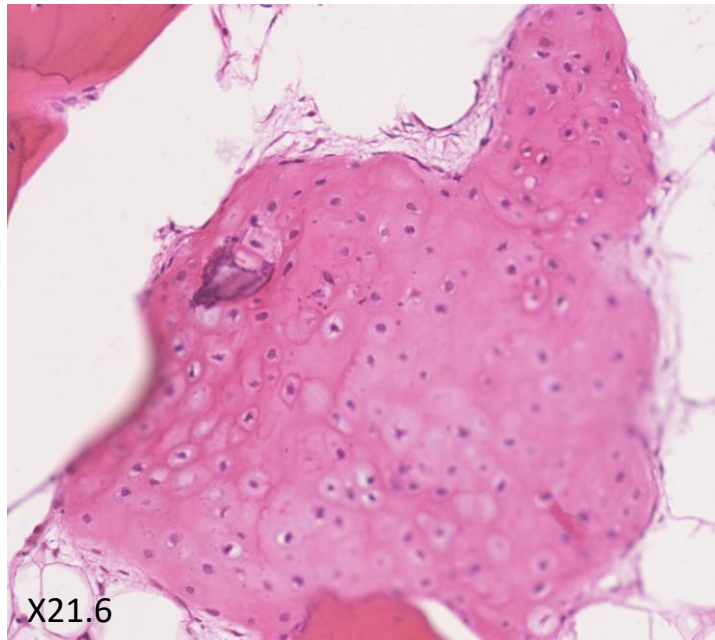
x3.6

H&E



x3.6

Saf-0



X21.6

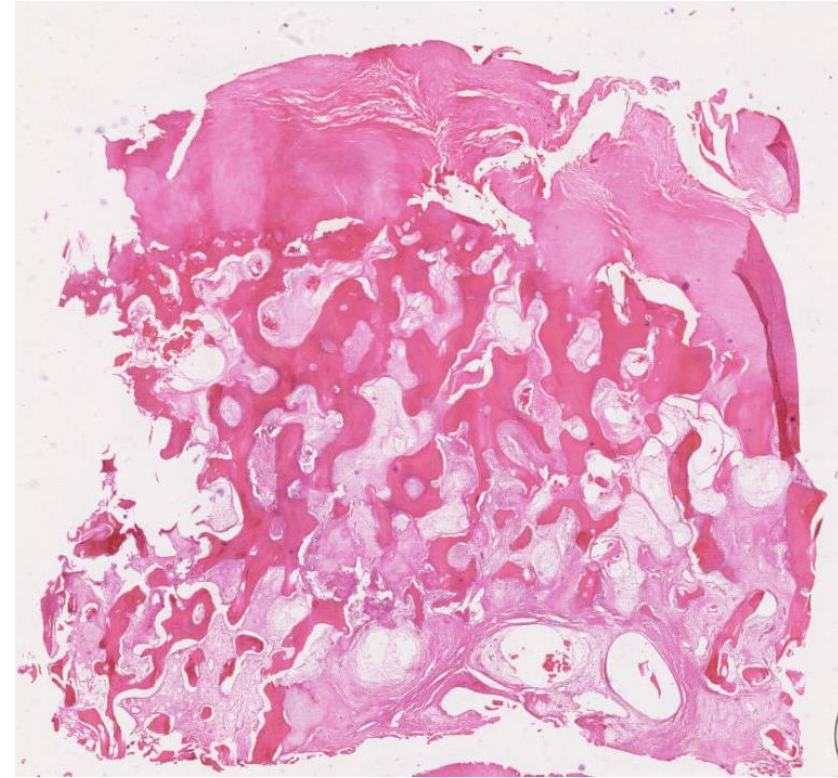
Chondrocytes
and
chondroblasts

Domain 5

THICKENED TRABECULAE (%)



NORMAL

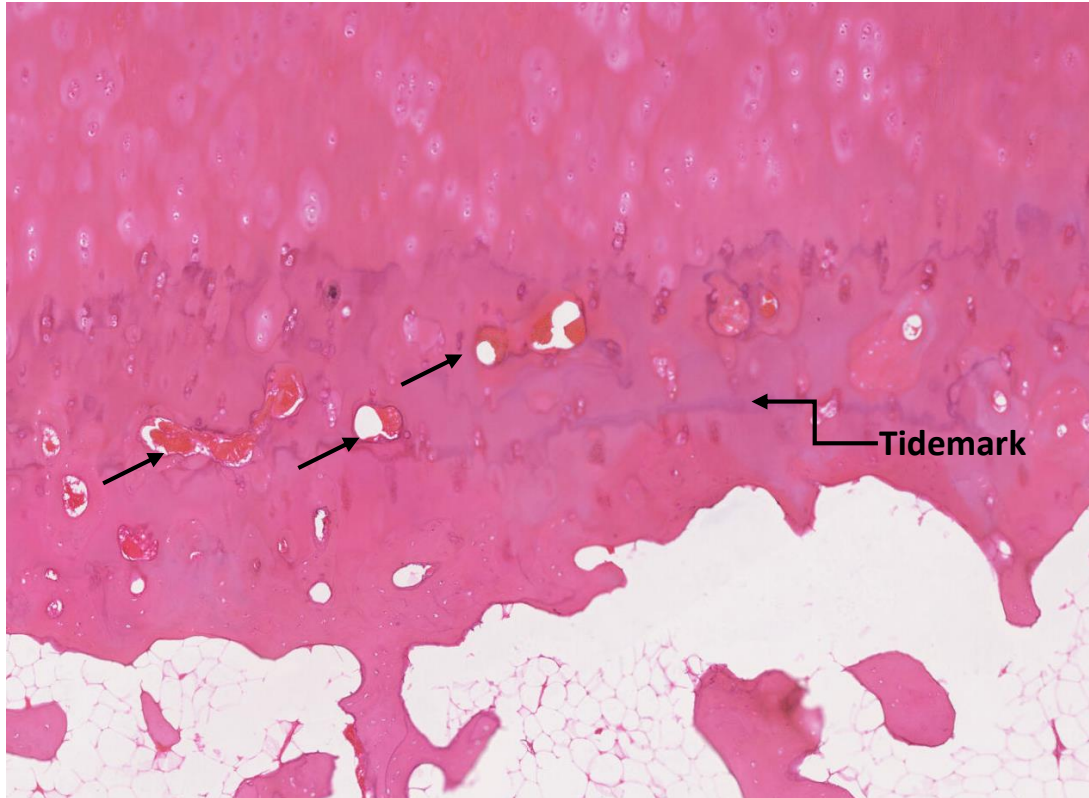


ABNORMAL

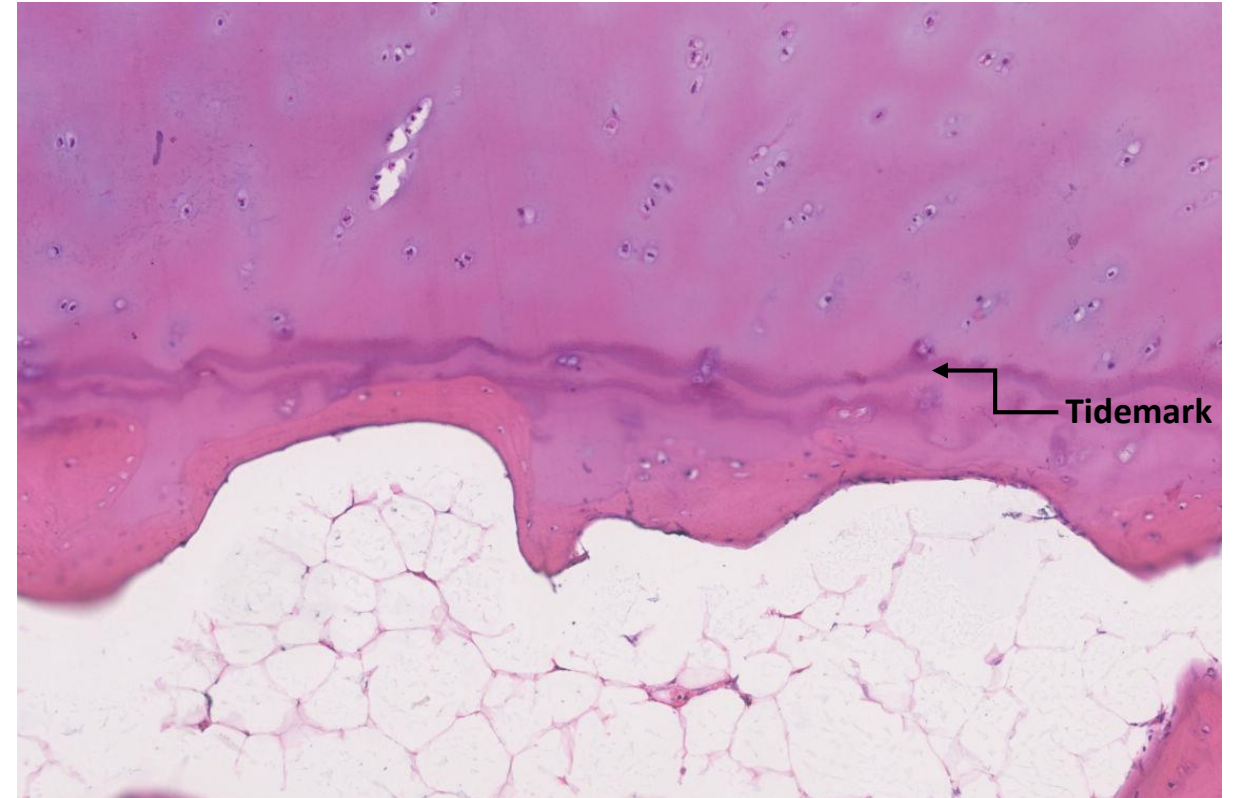
- Transformation of trabeculae from rod-like into plate-like
- > 33% of trabeculae thickened (at least).

Domain 6

TIDEMARK INTEGRITY



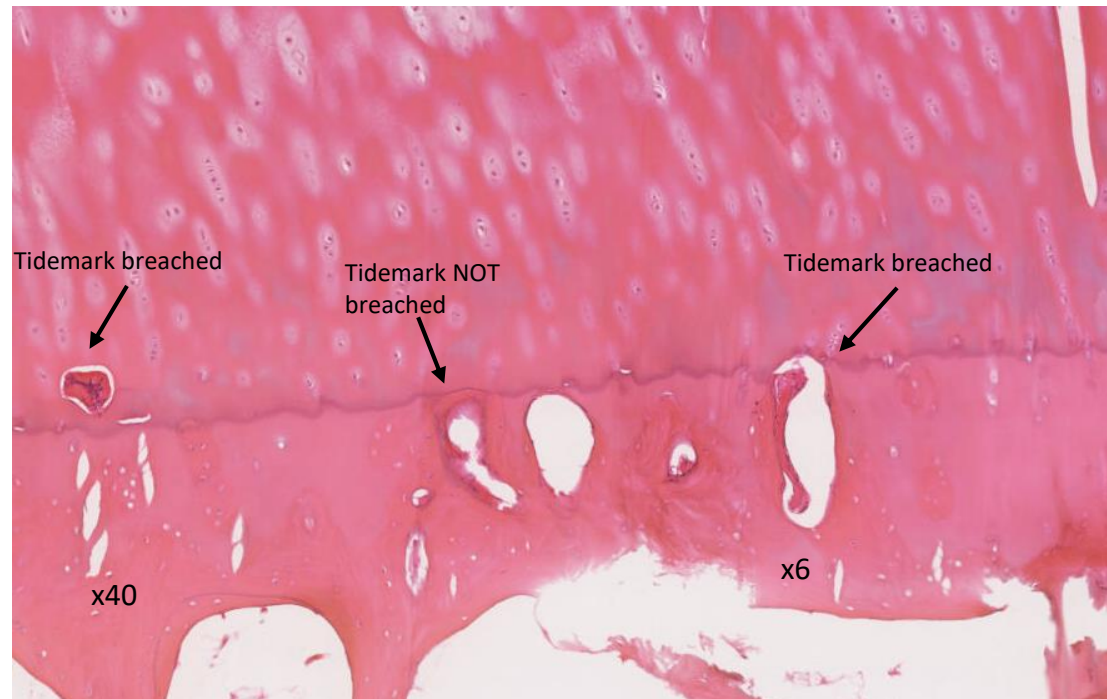
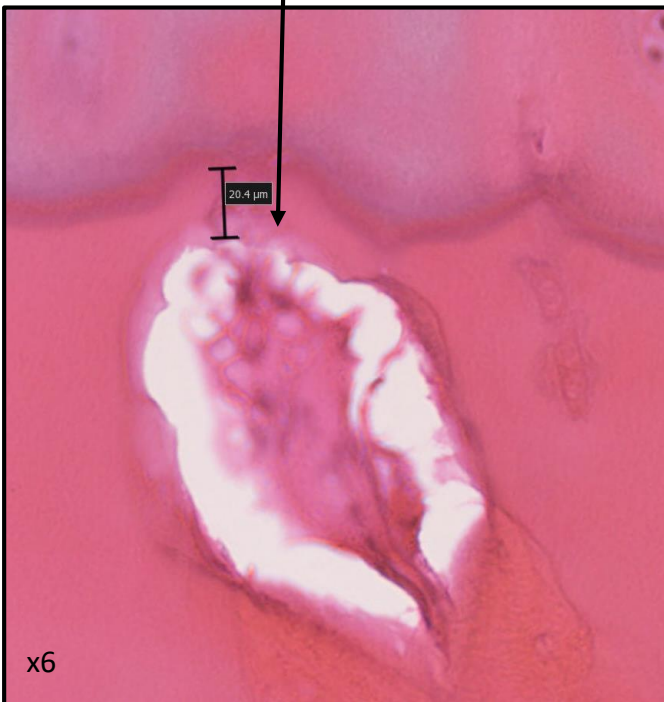
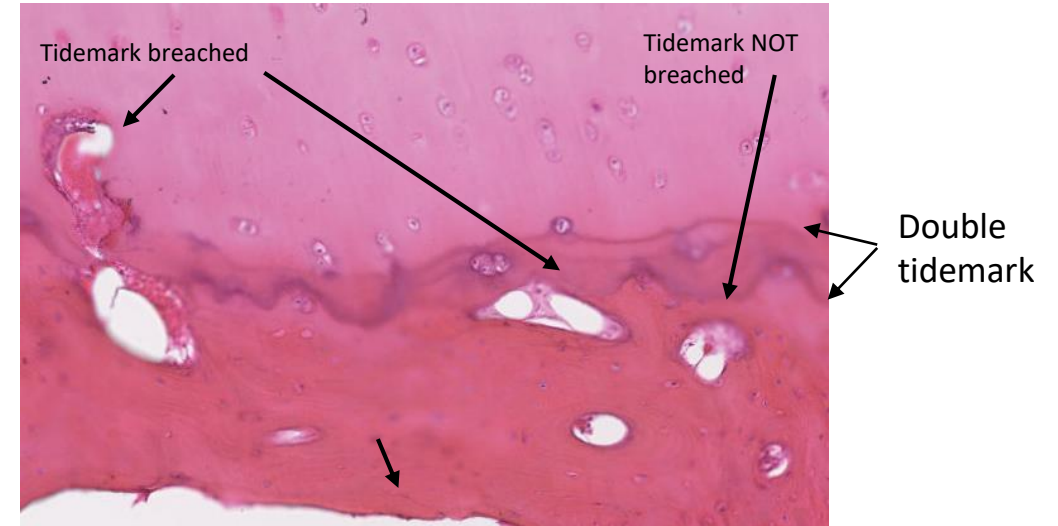
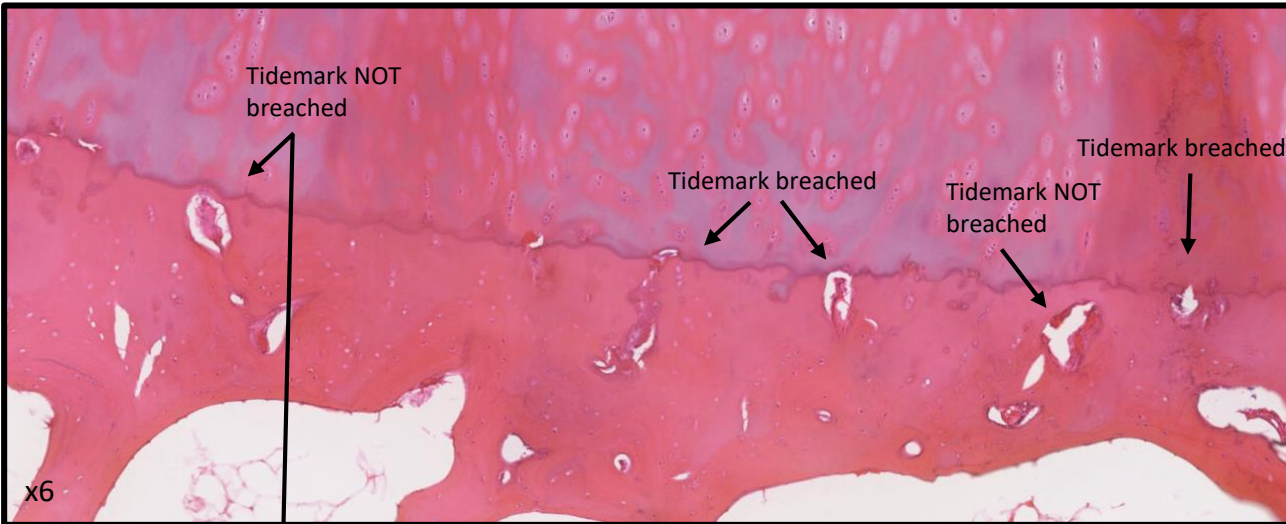
Tidemark breached



Tidemark NOT breached

- Extension of subchondral blood vessel through the tidemark
- At least 1 BV near OC junction penetrating tidemark

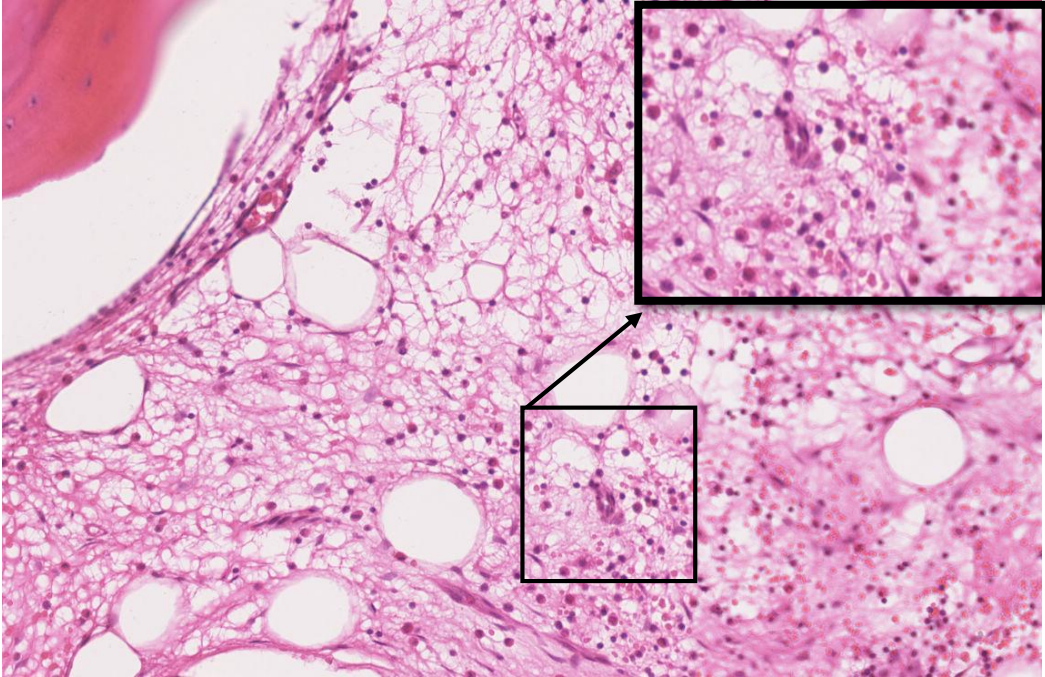
Examples of tidemark integrity



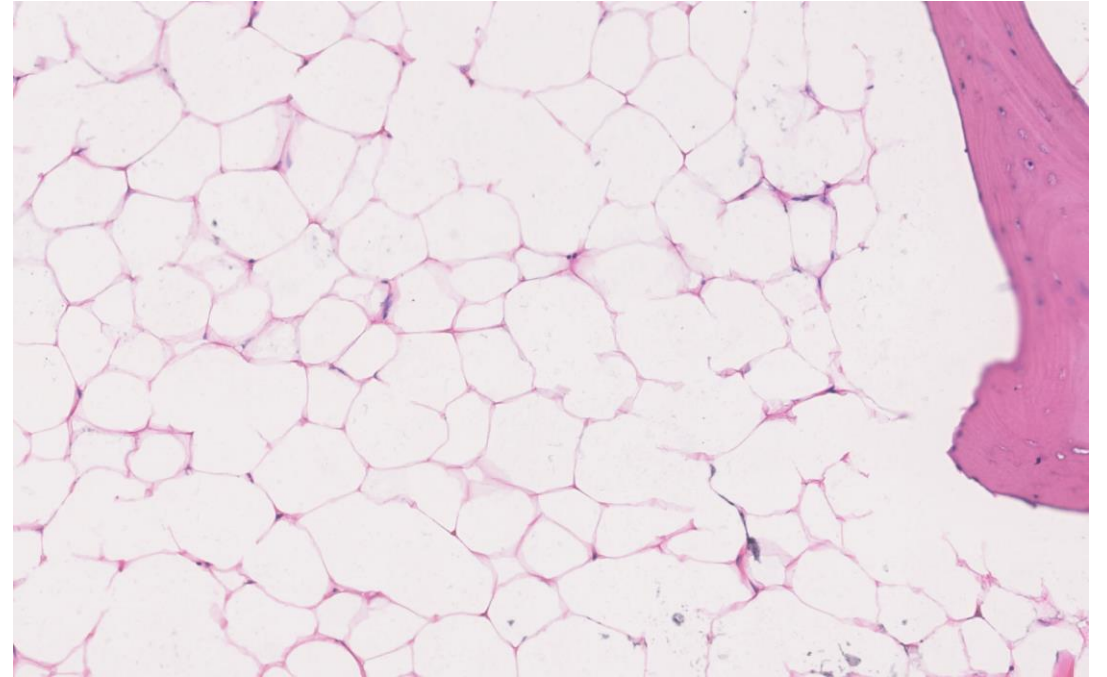
- If BV is touching the tidemark = **breached**
- If just below the tidemark (not touching) = **not breached**
- Ignore double tidemark, tidemark counts as breached if BV touches/breaches first tidemark.

Domain 6

INFLAMMATION



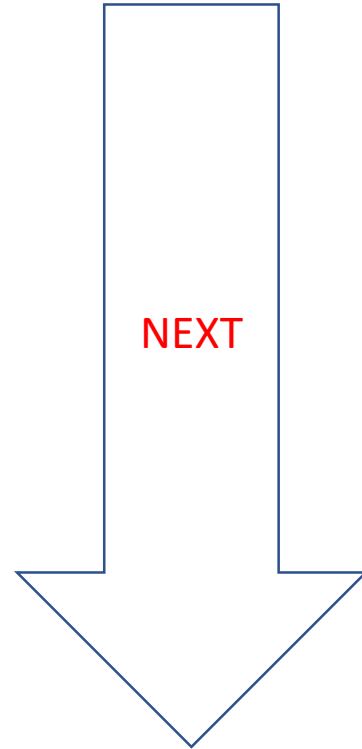
X 14.8



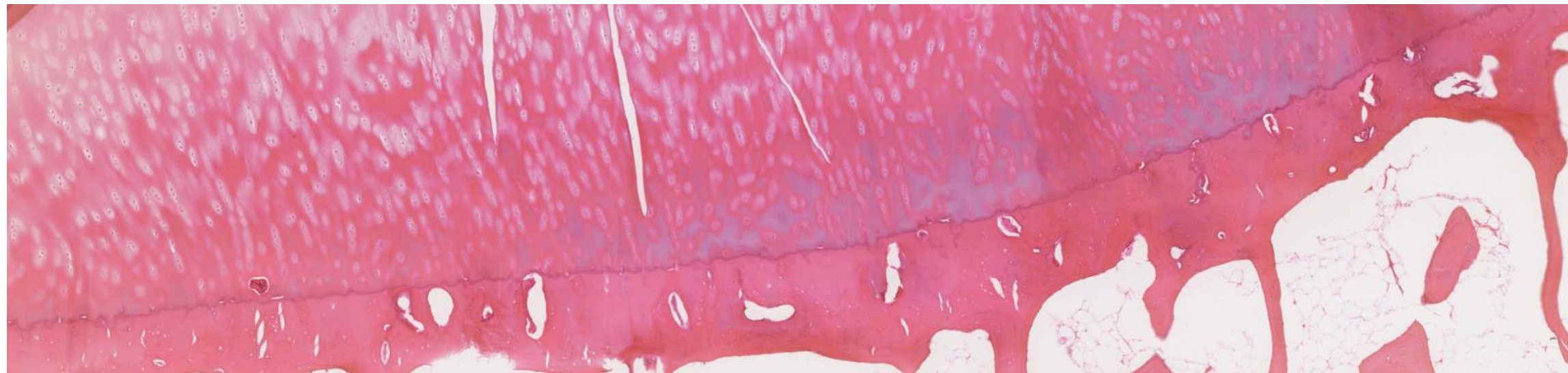
X 14.8

- Cellular infiltrates suggestive of inflammation - any of the following cells (does not have to be all cell types):
- macrophages, granulocytes, lymphocytes, osteoclasts.

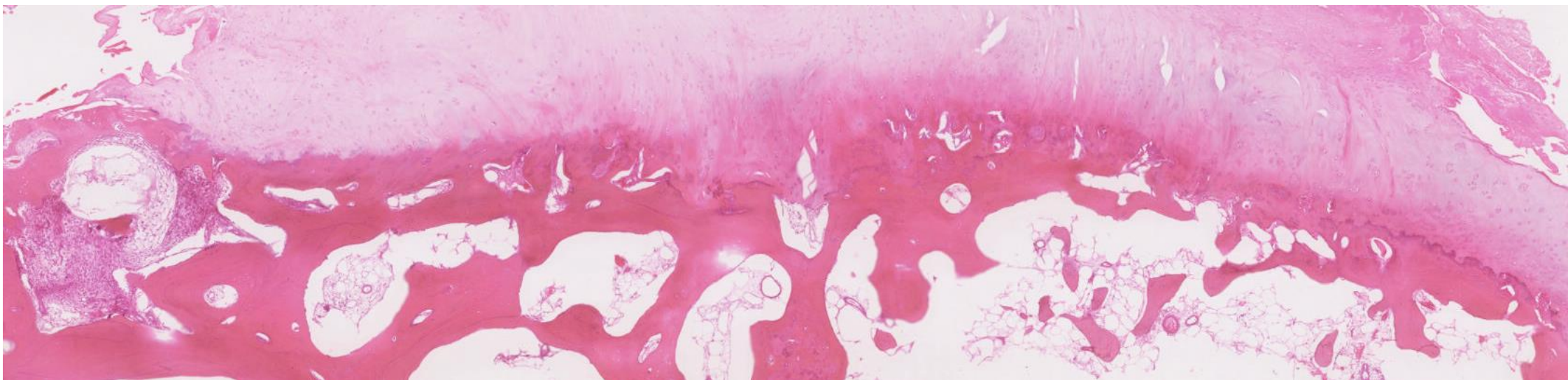
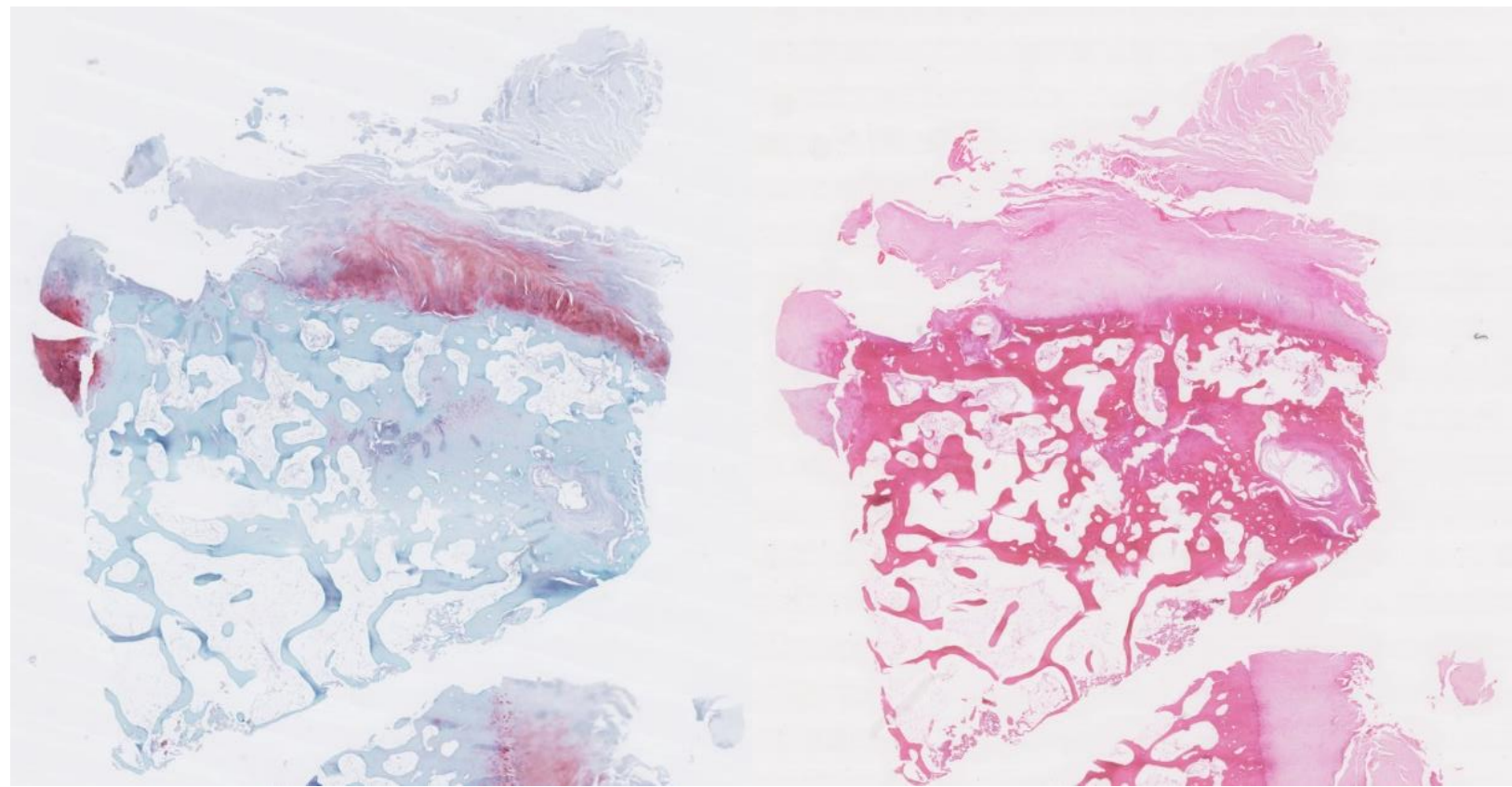
Below the tissues we have scored



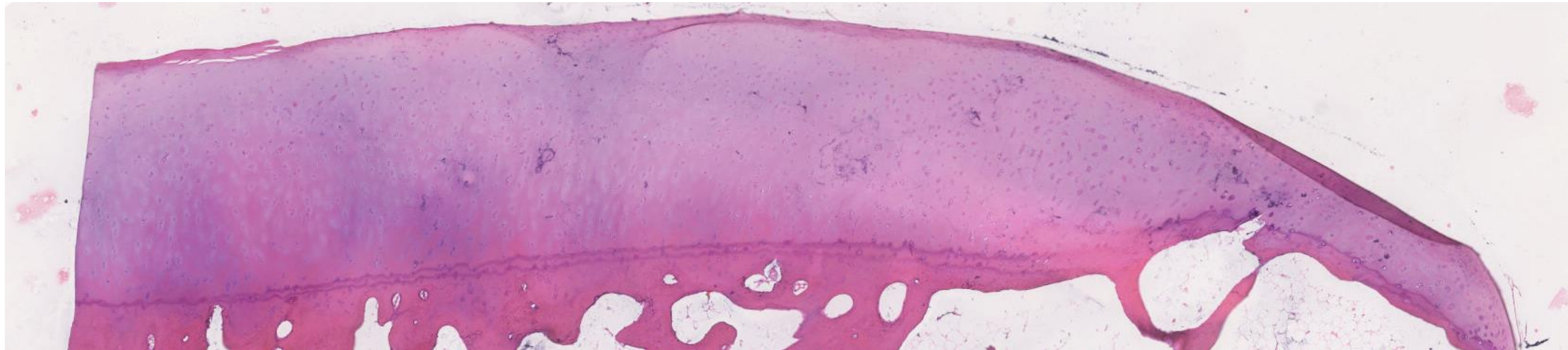
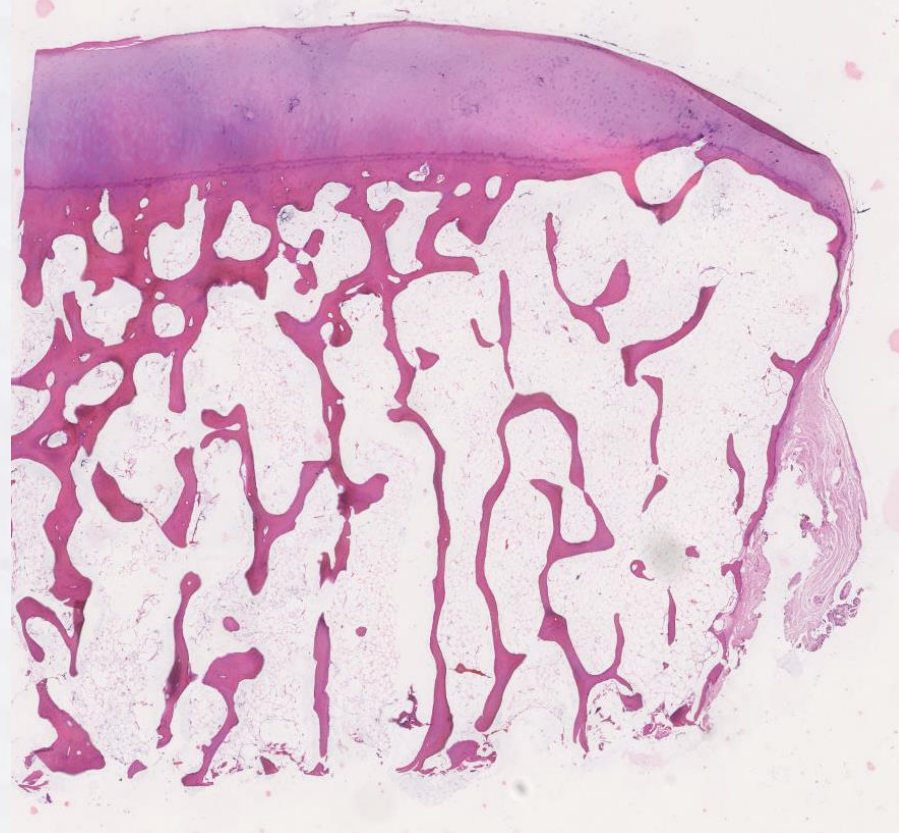
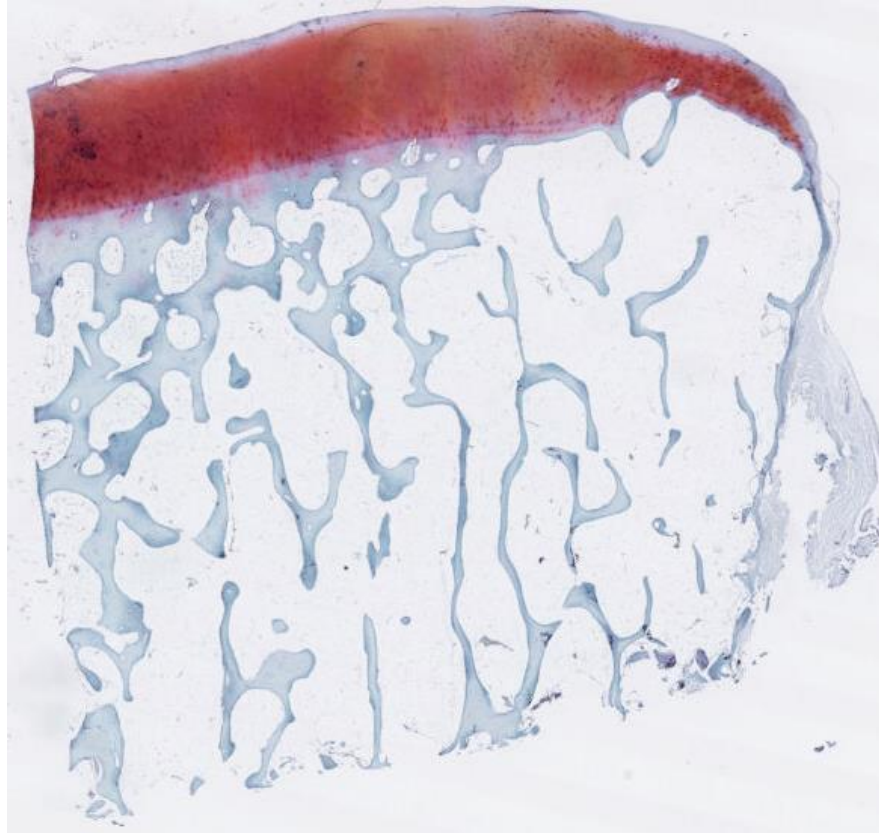
	Grade
Cyst	0
Fibrosis	0
Blood vessels (>15)	1
De novo cartilage	0
Thickened trabeculae	0
Tidemark integrity	1
Inflammation	0
Total	2



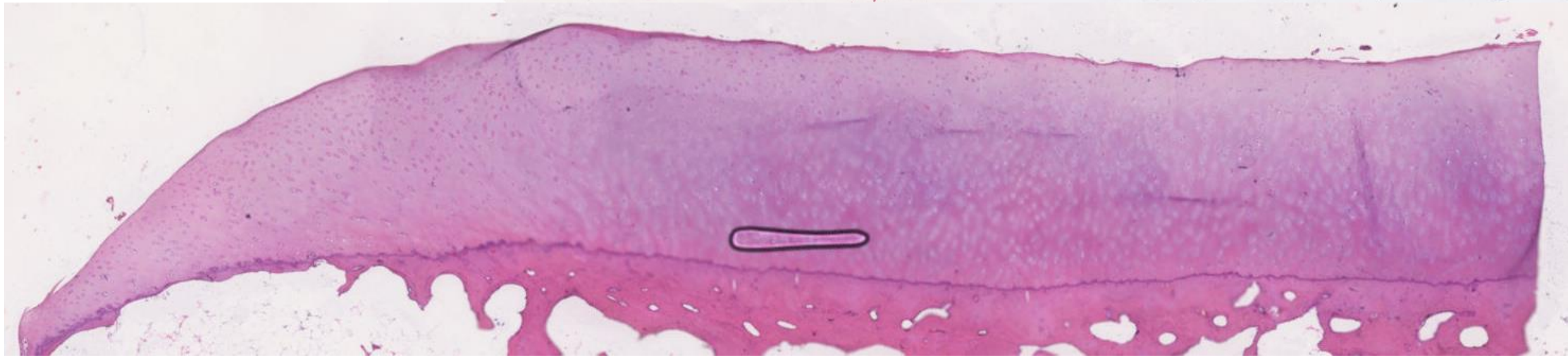
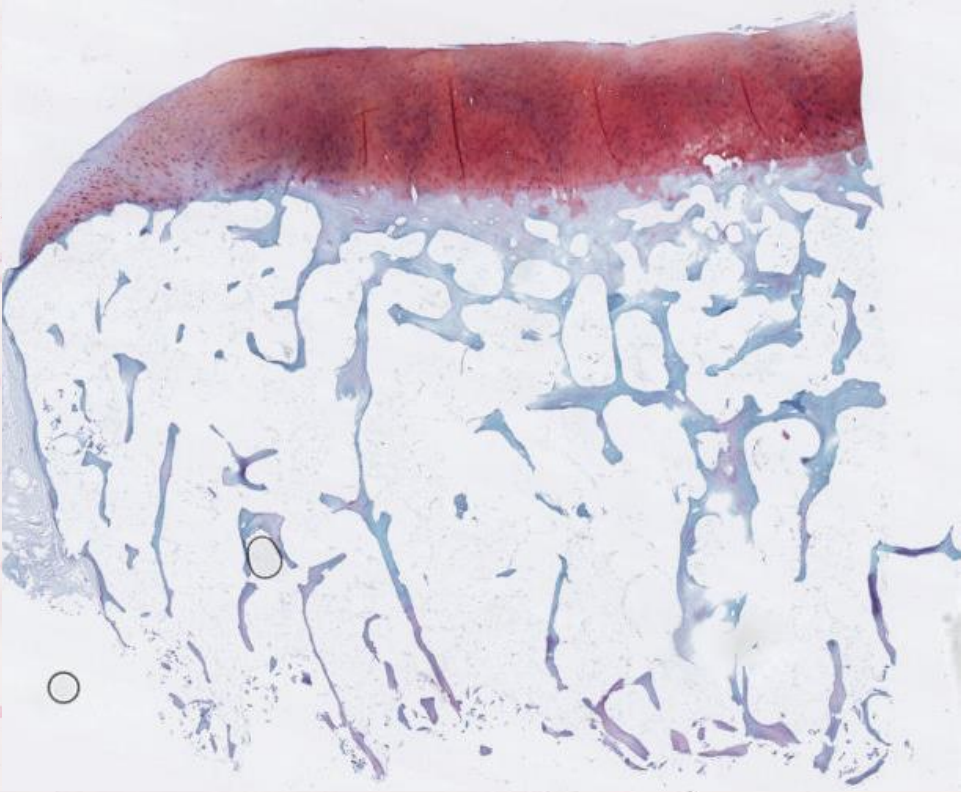
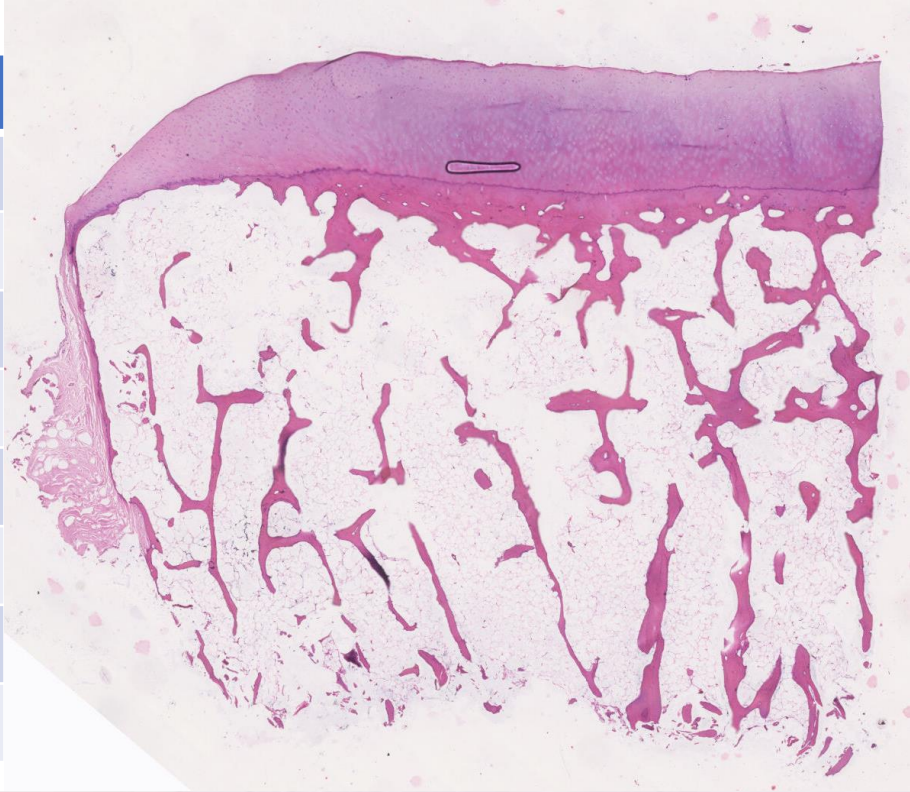
	Grade
Cyst	1
Fibrosis	1
Blood vessels (>15)	1
De novo cartilage	1
Thickened trabeculae	1
Tidemark integrity	1
Inflammation	1
Total	7



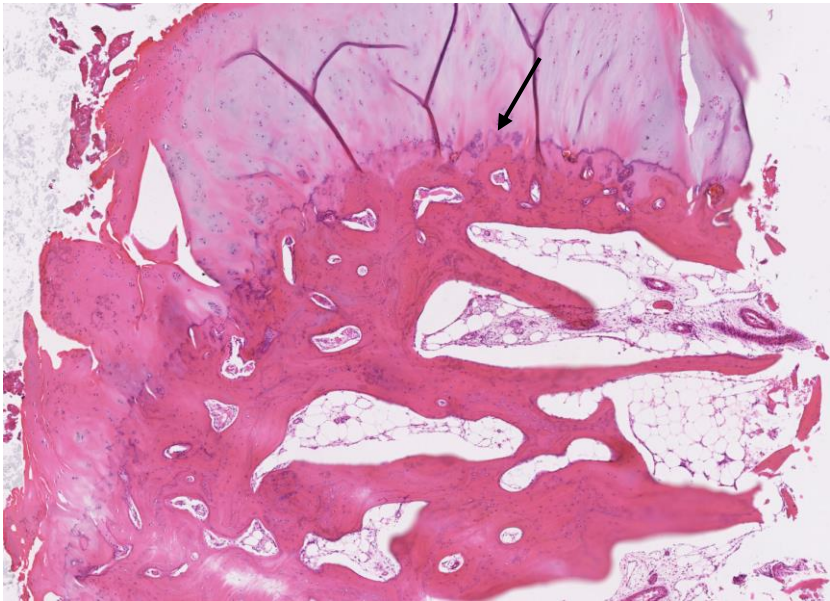
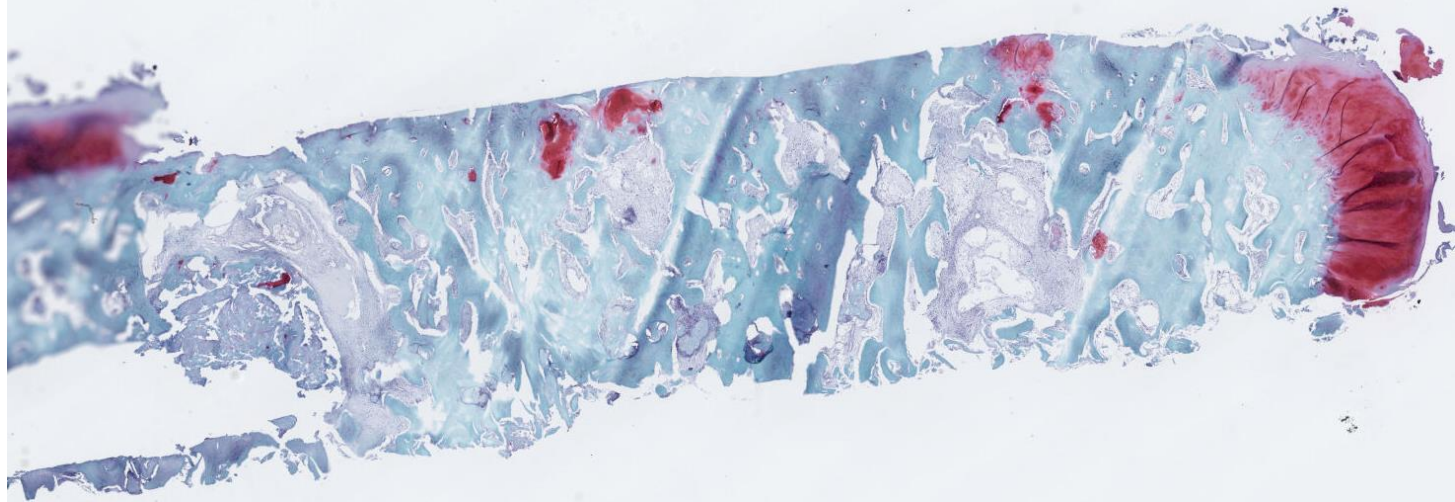
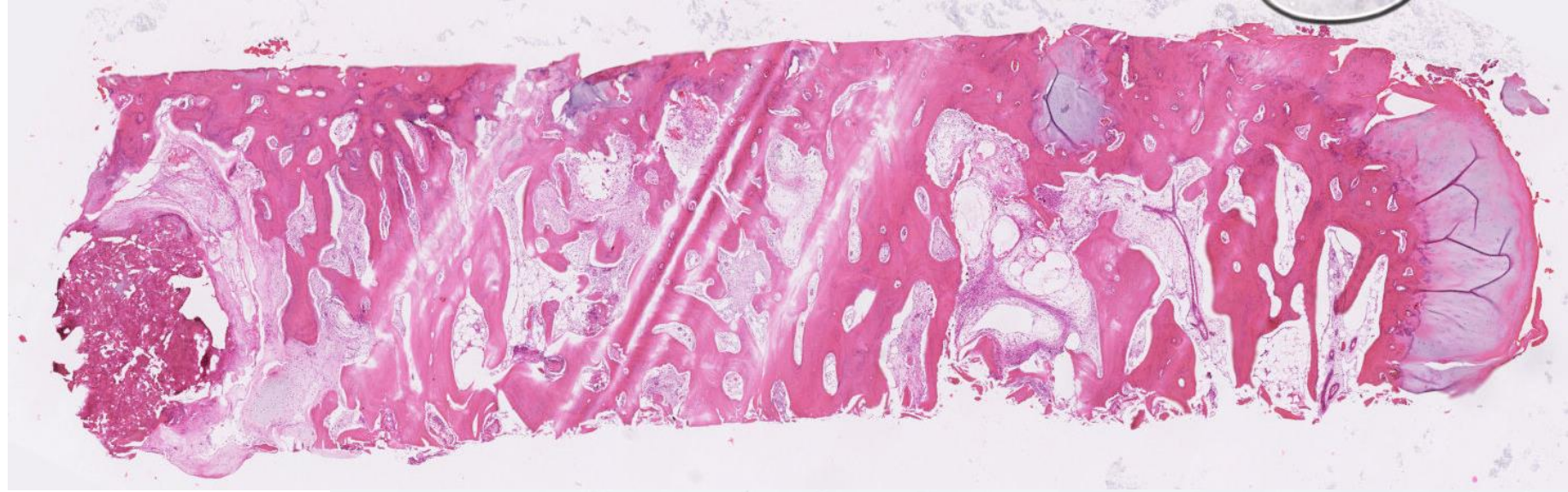
	Grade
Cyst	0
Fibrosis	0
Blood vessels (>15)	0
De novo cartilage	0
Thickened trabeculae	1
Tidemark integrity	1
Inflammation	0
Total	2



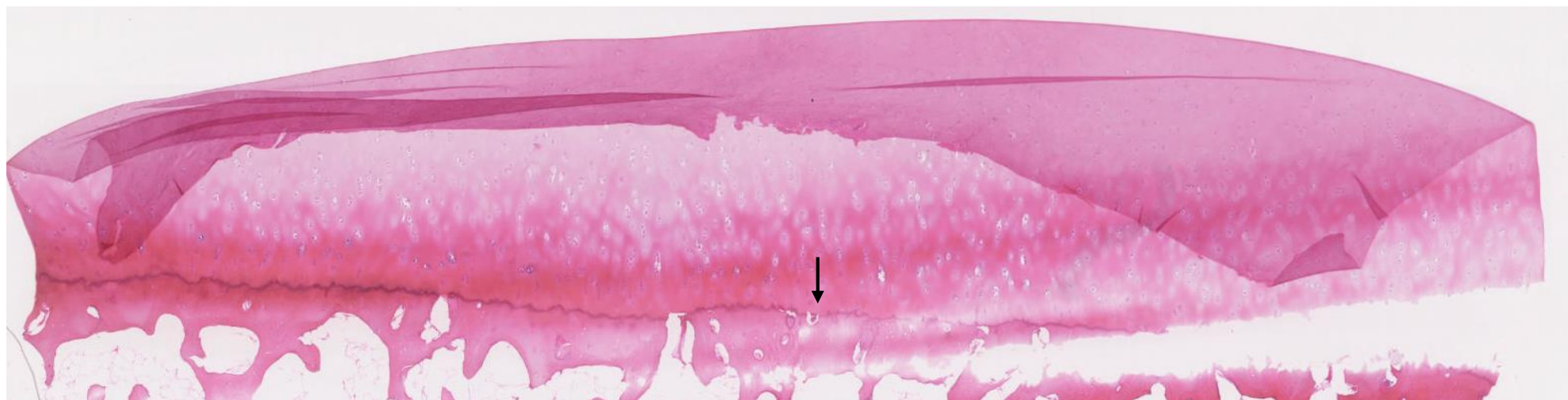
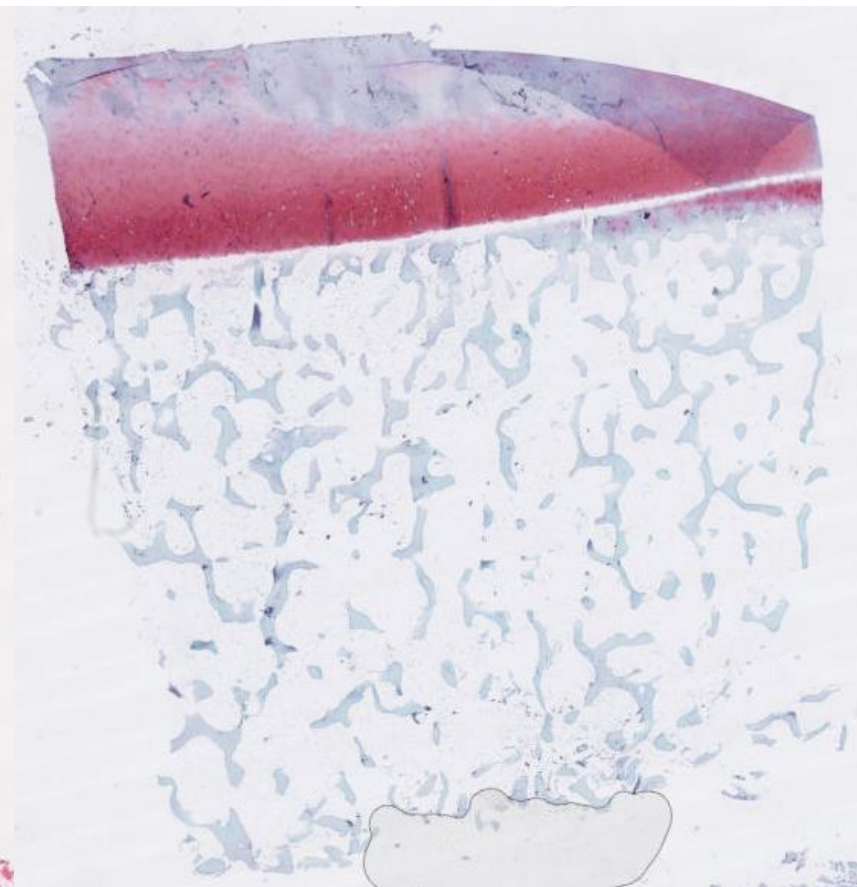
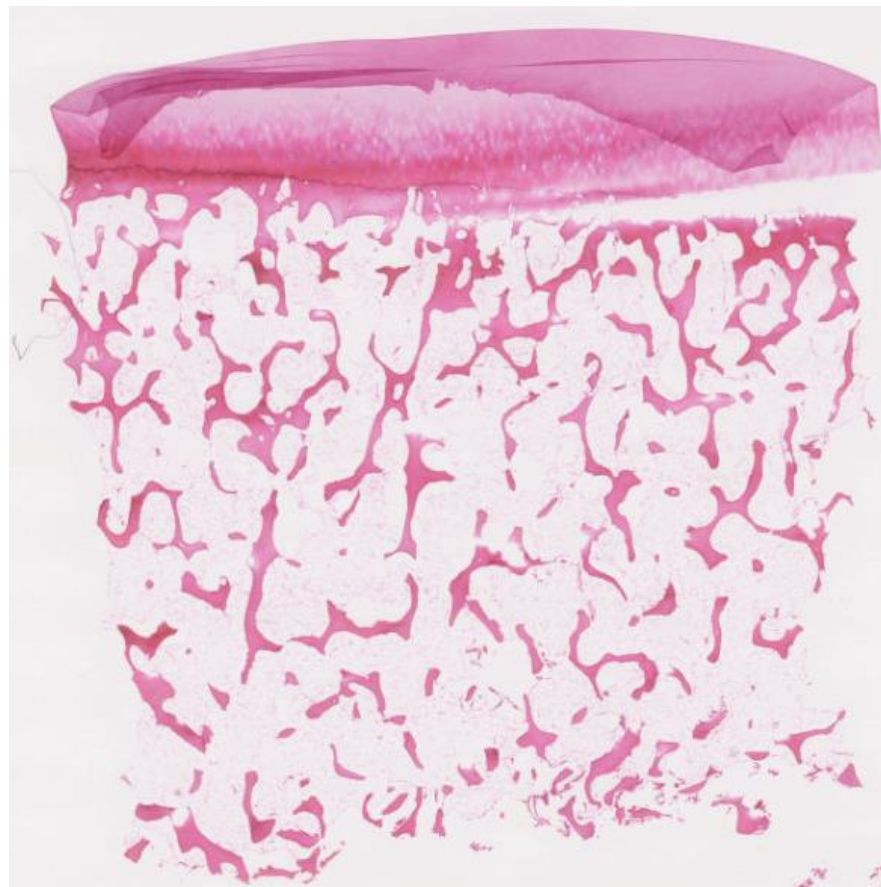
	Grade
Cyst	0
Fibrosis	0
Blood vessels (>15)	0
De novo cartilage	0
Thickened trabeculae	1
Tidemark integrity	1
Inflammation	0
Total	2



	Grade
Cyst	1
Fibrosis	1
Blood vessels (>15)	1
De novo cartilage	1
Thickened trabeculae	1
Tidemark integrity	1
Inflammation	1
Total	7



	Grade
Cyst	0
Fibrosis	0
Blood vessels (>15)	1
De novo cartilage	0
Thickened trabeculae	0
Tidemark integrity	1
Inflammation	0
Total	2



	Grade
Cyst	1
Fibrosis	1
Blood vessels (>15)	1
De novo cartilage	0
Thickened trabeculae	1
Tidemark integrity	1
Inflammation	1
Total	6

