Interaction between Bone Substitute and Socket Shield: A Case Report with Human Histological Specimen

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Introduction

There has been an increasing attention and concern to intentionally placing dental implant with remaining tooth root fragments. The concept of retaining part of the buccal root shield (Socket Shield) in conjunction with immediate implant placement and provisionalization (IIPP) is to preserve the bundle bone as well as the facial gingival contour. Histology findings from previous studies have shown signs of osseointegration. New bone formation were noticed between implant and the root dentin. However, histology results of interaction between grafted bone and remaining root dentin is still lacking.

Aim

The purpose of the current study is to exam the histology result of a retrieved implant specimen after performing IIPP with retained socket shield. This implant was failed 1.5 months after the implant surgery.

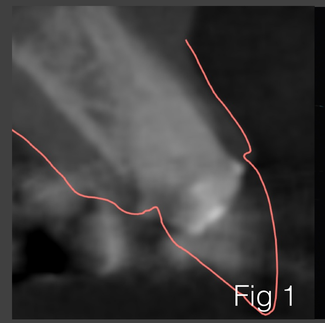


Fig 1

Fig 2

Fig 3

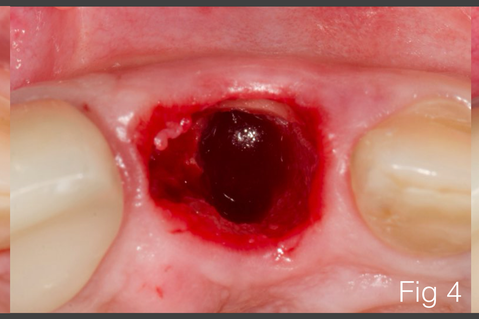


Fig 4

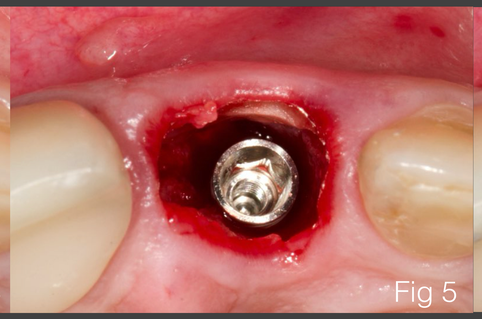


Fig 5

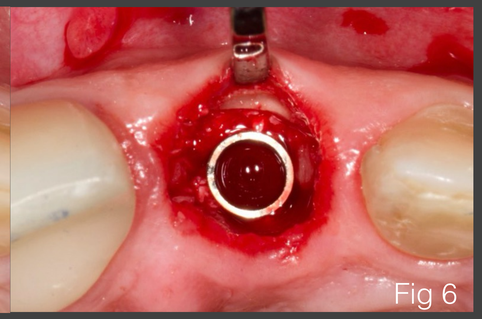


Fig 6

#9 was bisected by using a long diamond bur (Fig 1-3). The attempt was to keep the buccal portion of the root and remove the rest of the root structure. The remaining facial root fragment was prepared using diamond burs to form a C-shape and the coronal portion of the root shield was reduced to the level of buccal bone. The inner surface of the root at coronal side was beveled to provide room for emergence profile of the provisional crown (Fig 4). A slurry mixture of tetracycline and 0.12 % chlorhexidine gluconate was used to clean the dentin surface of the prepared root fragment as well as the residual socket. The implant osteotomy was performed in the extraction socket with the aid of a surgical template . After preparation of the implant recipient site, a dental implant was placed (Fig 5). Primary stability was achieved by engaging the palatal wall. A provisional shell was picked up and adjusted according to intraoral situation. The gap between the buccal root shield and the implant was grafted with bone substitutes (Fig 6).

Case Report

A 50 years old female presented with #9 fractured to gingival level. This tooth has been retreated endodontically and deemed as hopeless (Fig 1). IIPP was performed with retained root shield on the buccal side. The gap between implant and socket shield was grafted with 50:50 mixed allograft and xenograft bone substitutes.

1.5 months later, patient came back for post-op check. The implant showed signs of early failure and was surgically removed (Fig 2). The extraction socket was debrided thoroughly and the grafted with 100% allograft. A piece of free gingival graft was harvested from the palate and transferred to “seal” the socket (Fig 3).

6 month later, this site was reentered (Fig 4,5). After raised a full thickness flap, the remaining shield was noticed with class I mobility (arrow). A decision was made to remove the shield and send for histology examination (Fig 6).

Fig 1

Fig 2

Fig 3

Fig 4

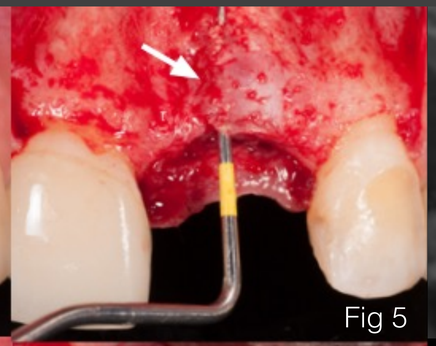
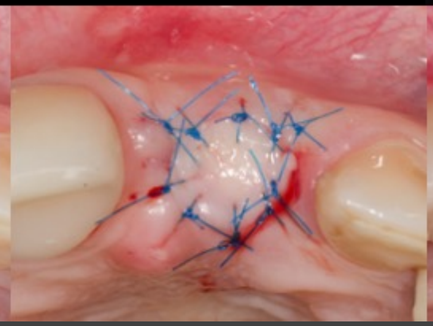
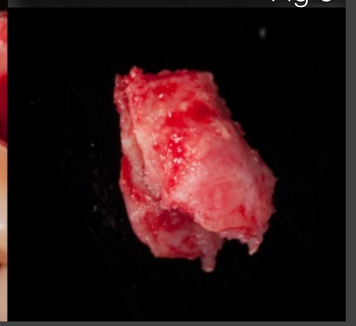


Fig 5

Fig 6





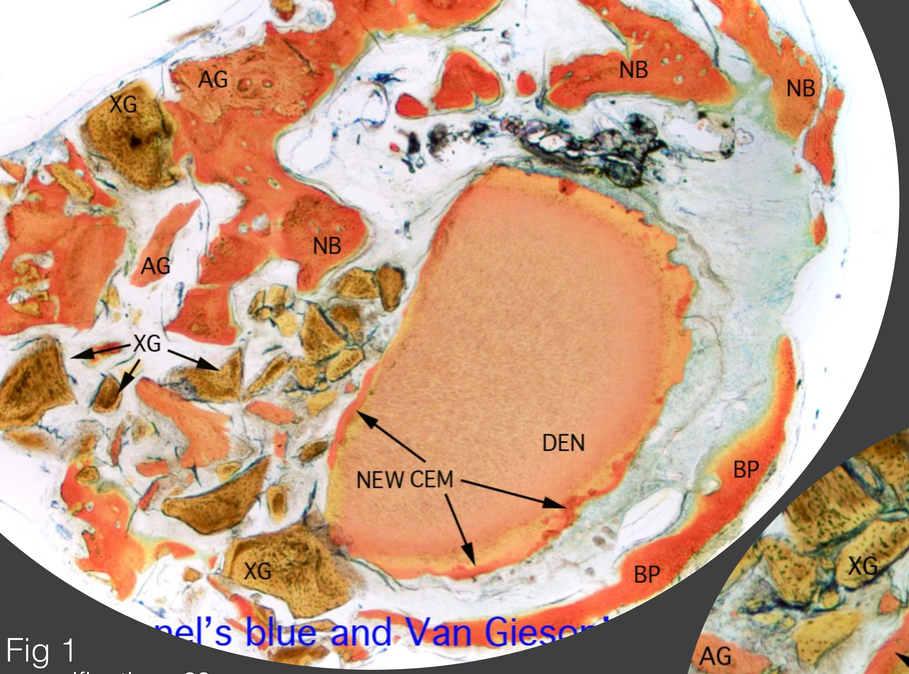


Fig 1
magnification x20

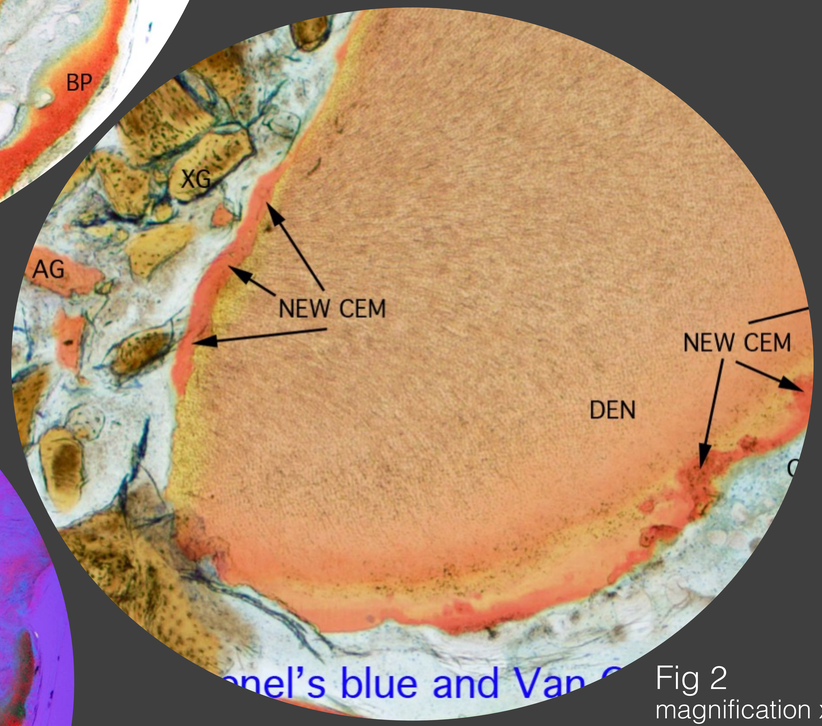


Fig 2
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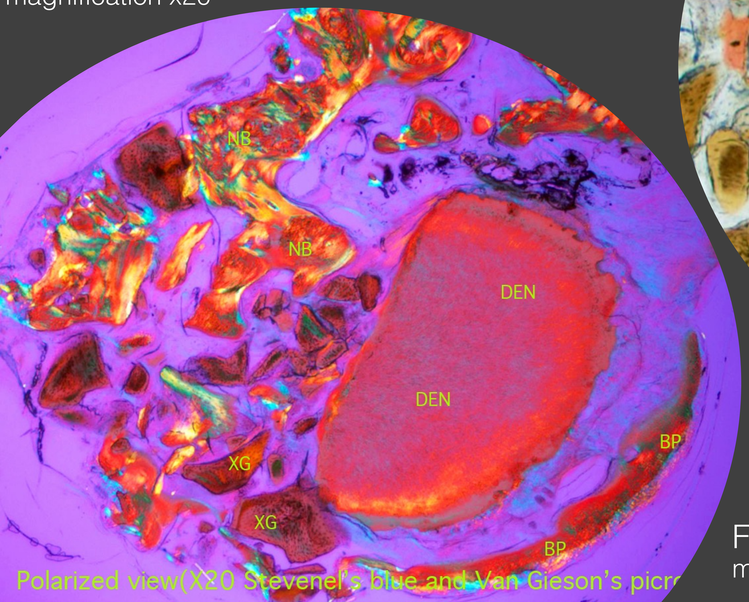

Fig 3
magnification x20

Histology Findings

Histology specimen was harvested 7.5 months after the implant surgery (Fig 1). At this stage, majority of the bone is actively growing (Fig 3). The histomorphometric analysis shows 46 % of bone and 51 % of marrow or fibrous tissue. 67 % of the bone are vital.

New cementum formation is obvious around the periphery of the root (Fig 1,2). The buccal plate bone shows intensely active bone formation with lots of immature bone.

New cementum formation is obvious in the red areas and red with overlying green areas around the periphery of the root (Fig 1). The area to the left of the root shows xenograft with no new bone associated with it. The root is surrounded by cellular connective tissue. The cellularity is composed of fibroblasts, osteoblasts and cementoblasts with virtually no indication of inflammatory cells.

There was no interaction between dentin and bone graft (Fig 2, noticed lower left area where root dentin is in contact with xenograft particle). Although there was evidence of new cementum formation covering the dentin, no interaction with new bone was found.

Overall

AG- Allograft, **BP**- Buccal Plate, **CT**- Connective Tissue, **DEN**- Dentin, **NB**- New Bone, **NEW CEM**- New Cementum, **XG**- Xenograft

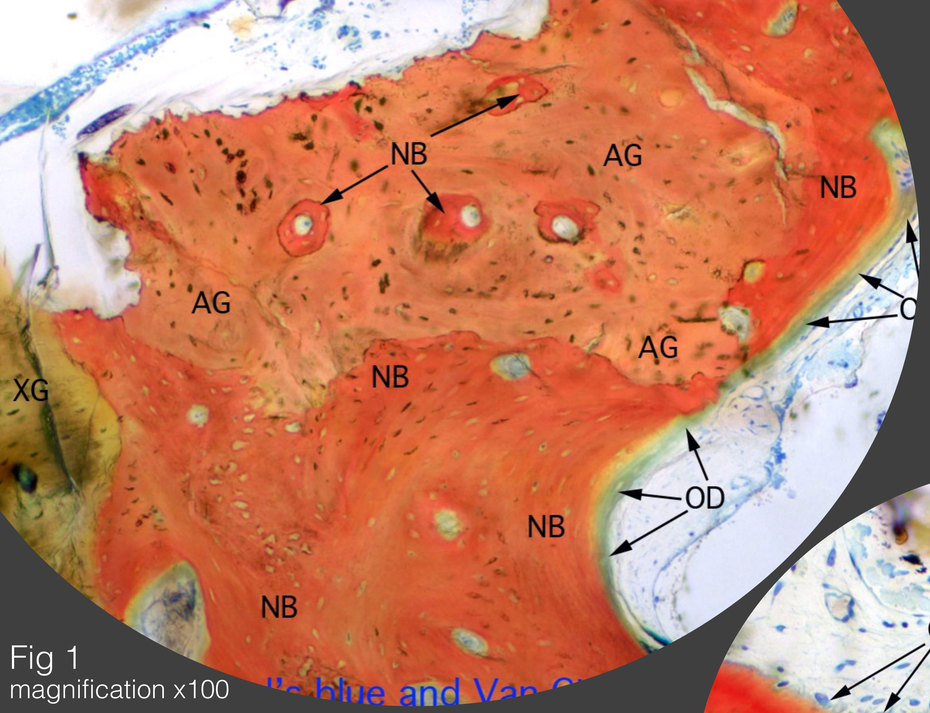

Fig 1
magnification x100

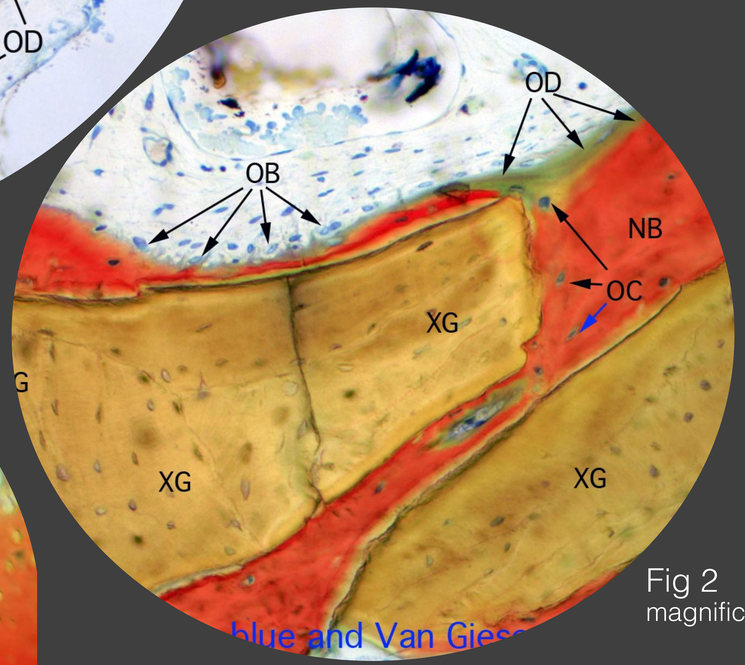

Fig 2
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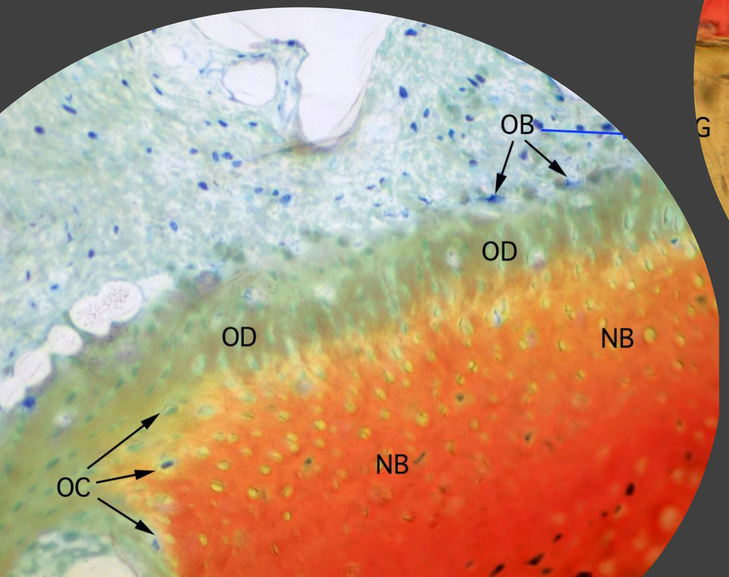


Fig 3
magnification x200

Histology Findings

New bone formation was also found around graft material (Fig 1,2). Figure 1 shows bone formation in relation to bone allograft and xenograft. In the upper right, red-staining new bone is forming around a piece of lighter staining allograft. An intense band of green-staining osteoid, lined by numerous osteoblasts surrounds this new bone. The new bone both surrounds and infiltrates the allograft, even noticed formed within the haversian canals of the allograft.

On the contrary, even though new bone is forming around xenograft particles (Fig 2), numerous xenograft particles show no associated bone formation (Page 3, Fig 1).

Figure 3 showed how new bone formed. The osteoblasts (OB) produce the light green-staining osteoid (OD), become entrapped in the osteoid and become osteoblasts as the bone matures. The maturing bone can be seen changing from light green to yellowish green, to yellow, to light red, to a more intense red.

New Bone Formation

AG- Allograft, **NB**- New Bone, **OB**- Osteoblasts, **OC**- Osteocyte, **OD** – Osteoid, **XG**- Xenograft

Histology Findings

Figure 1 shows high vascularity (angular clear spaces surrounded by flattened endothelial cells) in the light blue/green-staining connective tissue. The immature buccal plate bone shows intensely active bone formation with osteoblasts forming green-staining osteoid, which matures through yellow/red-staining immature bone into intensely red young but maturing bone. The left side of the slide is the tooth root surrounded by cementoblasts forming green-staining cementoid and red-staining immature cementum.

New cementum forming on the tooth root is evident in the very high-power view (Fig 10). Newly formed cementum lines the surface of the dentin and green-staining cementoid, which will mature to cementum, is on the surface of the dentin in some places but generally on the newly formed cementum. Light blue-staining fibroblasts are present in the connective tissue and darker, biconcave red blood cells are seen within the blood vessel of this healthy, non-inflamed tissue.

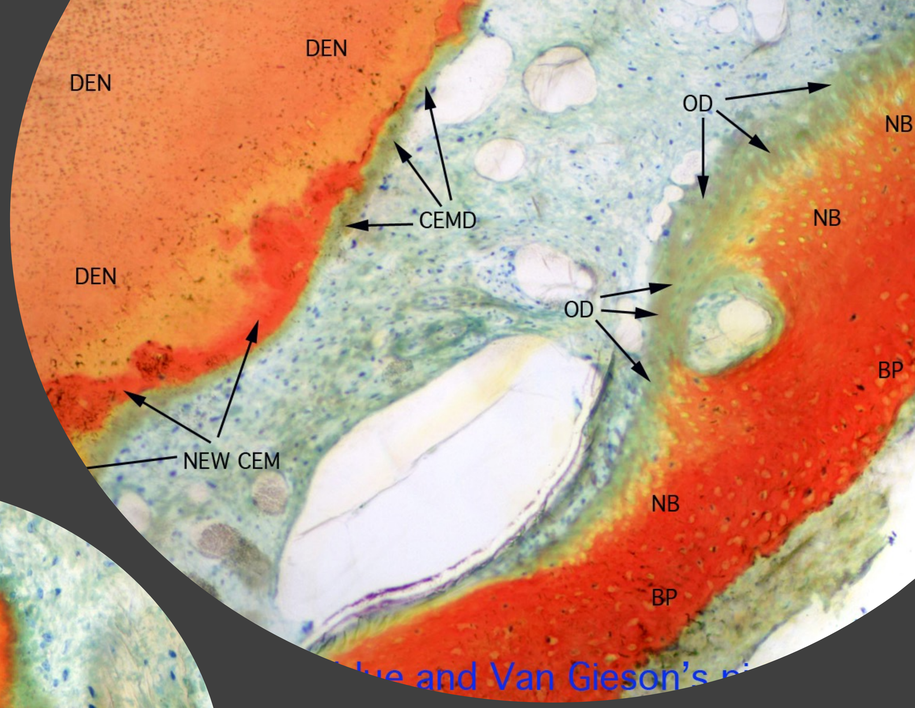
Conclusion

Although new cementum formation was found covering the remaining root dentin surface, the human histological specimen in 7.5 month showed no interaction between the dentin and bone substitute. The new bone formation was mainly from grafted bone substitutes, not from cementum.

New Cementum Formation

BP- Buccal Plate, **DEN**- Dentin, **CEMB**- Cementoblasts, **CEMD**- Cementoids, **NEW CEM**- New Cementum, **NB**- New Bone, **OD** – Osteoid, **SF** – Sharpey's Fibers

Fig 1
magnification x100



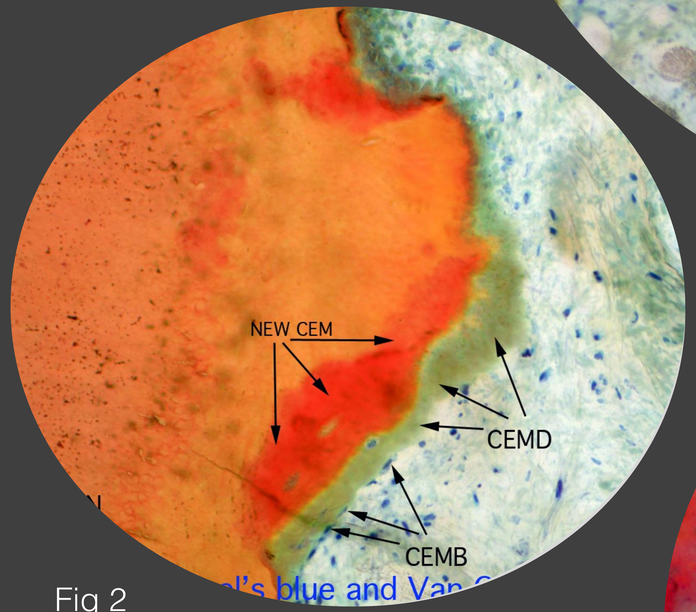


Fig 2
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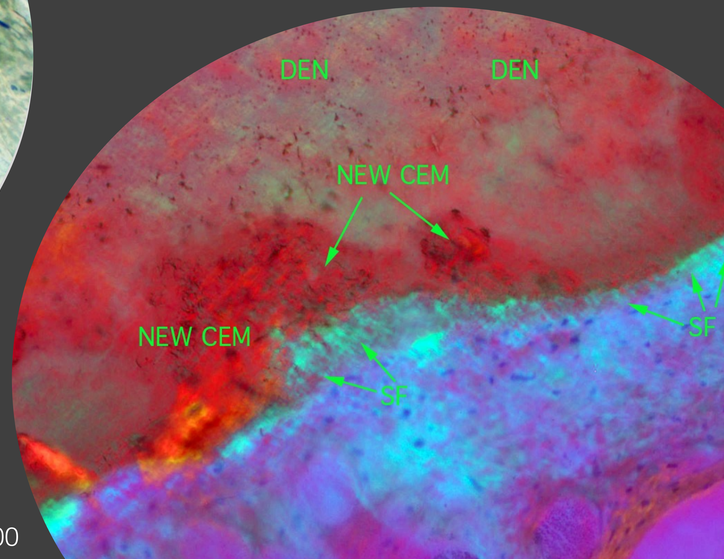

Fig 3
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