

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



December 8, 2021

MATERIALS LABORATORY FACTUAL REPORT

Report No. 21-096

A. ACCIDENT INFORMATION

Place : Las Vegas, Nevada
Date : October 29, 2020
Vehicle : Cessna 310R, N101G
NTSB No. : WPR21LA030
Investigator : Maja Smith, ASI-WPR

B. COMPONENTS EXAMINED

Components from a Continental Motors IO-520-series engine as follows:

- 1) Inserts for main bearings 1 – 5;
- 2) Inserts for connecting rod bearings 1, 2, 3, 5, and 6;
- 3) Thrust bearing.

C. DETAILS OF THE EXAMINATION

Main bearing inserts, connecting rod bearing inserts, and a thrust bearing from a Continental Motors IO-520-series engine were submitted to the NTSB Materials Laboratory for examination as shown in figure 1 – 3, respectively. All five main bearing inserts were submitted whereas for the connecting rod bearing inserts, only numbers 1, 2, 3, 5, and 6 were submitted. The main bearing inserts originated from Superior Air Parts and were labelled with Part Number: SA642839. The connecting rod bearing inserts originated from Continental Motors except for the numbers 3 and 6 bearings, where one half of the shell originated from Continental Motors and the other half of the shell originated from Superior Air Parts. The Continental Motors inserts were labelled with Part Number: 630826 / Lot Number: 08-17 and the Superior Air Parts inserts were labelled with Part Number: SA630826 L (L indicates the revision level of the part) / Lot Number: 01-19. No identifiers were observed on the thrust bearing.

Several of the inserts exhibited features consistent with heat exposure. The number 4 main bearing inserts were comparatively dark as were the numbers 3 and 6 connecting rod bearing inserts. The number 4 main bearing inserts exhibited heavy rubbing damage and removal of the babbitt on the bearing face. Metal had filled in much of the bearing groove, as seen in figure 4, obstructing five of the six oil through-holes. One each of the numbers 3 and 6 connecting rod inserts exhibited plastic deformation, extruding in the forward and aft directions.

The material in and around the oil through-holes was examined in greater detail by optical microscopy and scanning electron microscopy (SEM). Higher magnification images of the through holes on the number 4 main bearing left insert are shown in figures 5a – c. The uppermost hole, shown in figure 5a, exhibited a piece of melted and resolidified metal and copper-colored metal flakes adjacent to the hole. The two features were examined by an SEM equipped with an energy-dispersive X-ray spectrometer (EDS) and were determined to contain primarily lead/tin and copper, respectively, consistent with babbitt metal and backing material, respectively (not shown). The middle hole was obstructed by a gray-colored material, as shown in figure 5b. The material was examined by SEM/EDS and was determined to be composed primarily of aluminum (Al) and silicon (Si) with additional contributions from iron (Fe), copper (Cu), chromium (Cr) and nickel (Ni), as shown in figure 6a. The lower hole was obstructed by a gray-colored material over approximately 1/3 of the hole and the remainder was obstructed by a bronze-colored material. The bronze-colored region was examined by EDS and exhibited primarily Fe and Cu, as shown in figure 6b. The gray-colored region exhibited an EDS spectrum similar to that shown in figure 6a.

All of the main bearing left inserts exhibited features consistent with melted and resolidified metal near the insert end face, as shown in figures 7a – e for bearings 1 through 5, respectively. A silver-colored metal had pooled and solidified in the recess beneath the tang, in the groove, and on the bearing face, as indicated for insert number 2 in figure 7b. The composition of the metal was examined by EDS, as shown in figures 8a and b. The metal consisted primarily of lead (Pb) with additional amount of tin (Sn), and copper (Cu). A semi-quantitative method used to estimate the composition of the metal indicated that it was approximately 82% lead, 9% tin, and 9% copper. The results were most consistent with the material used for the babbitt layer.

Donald Kramer, Ph.D.
Sr. Materials Engineer

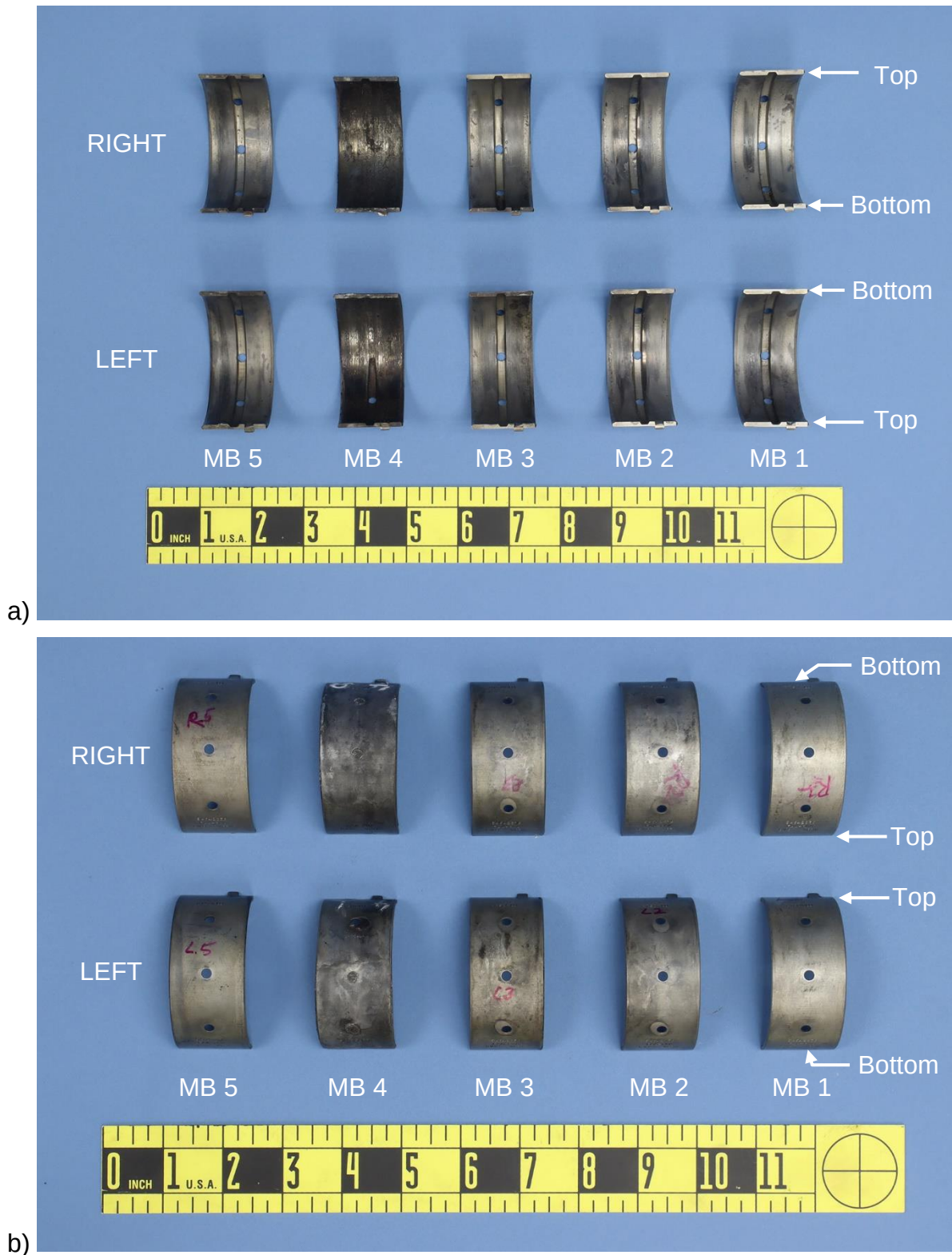


Figure 1: Main bearing inserts 1 through 5 – a) journal-bearing side and b) crankcase-facing backside.

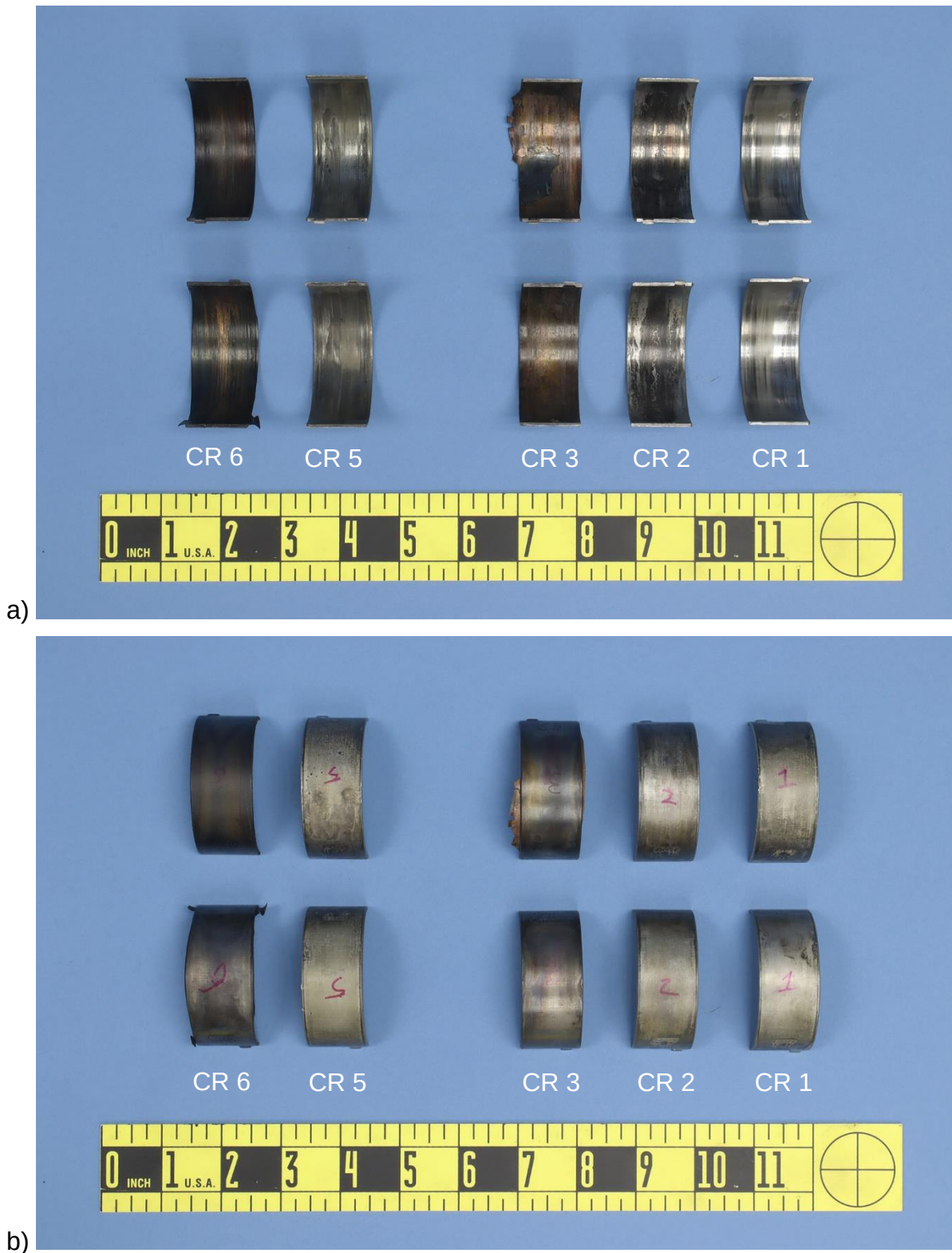


Figure 2: Connecting rod bearing inserts 1, 2, 3, 5, and 6 – a) journal-bearing side and b) backside.

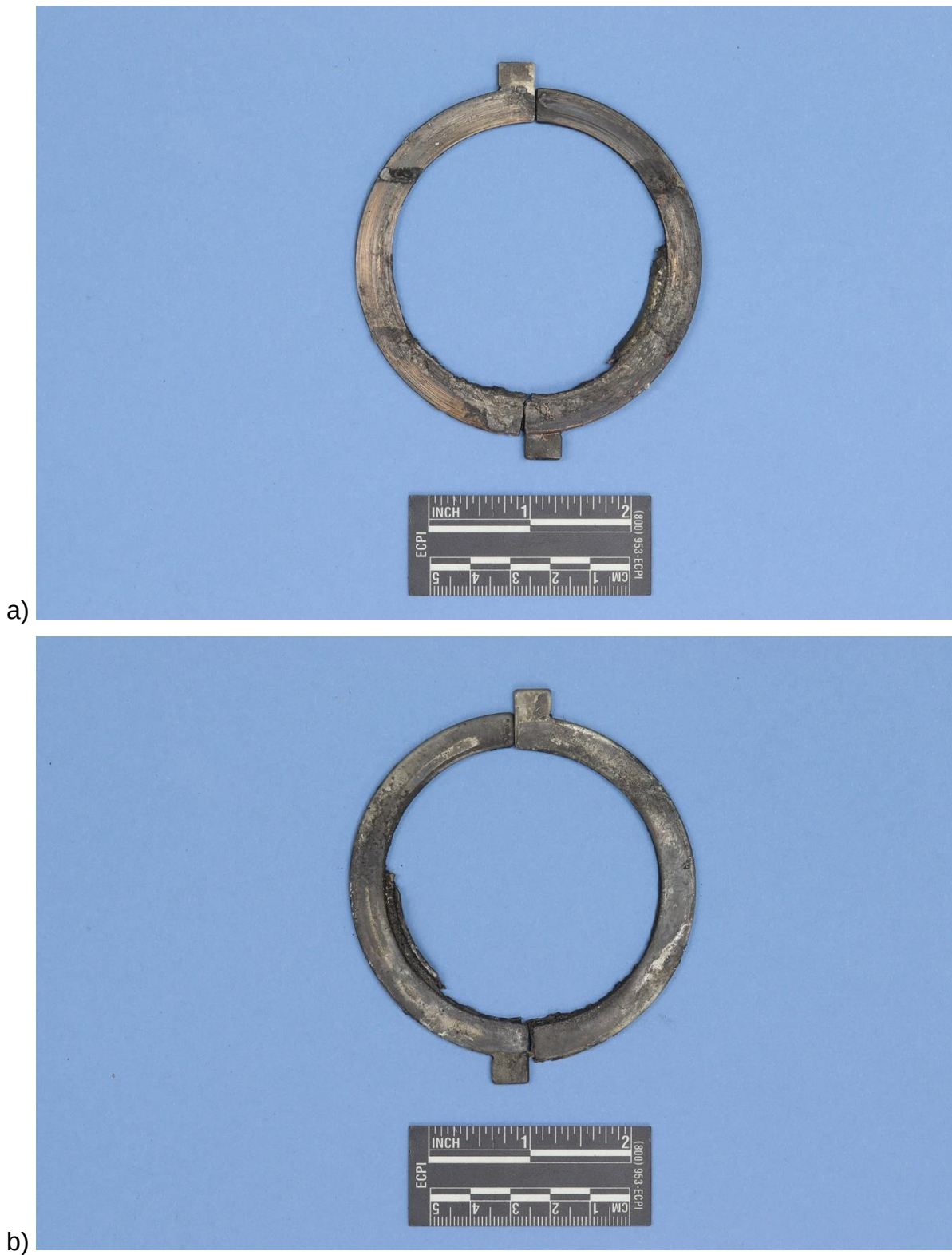


Figure 3: Thrust bearing aft of number 4 main bearing –a) Aft looking forward b) forward looking aft.

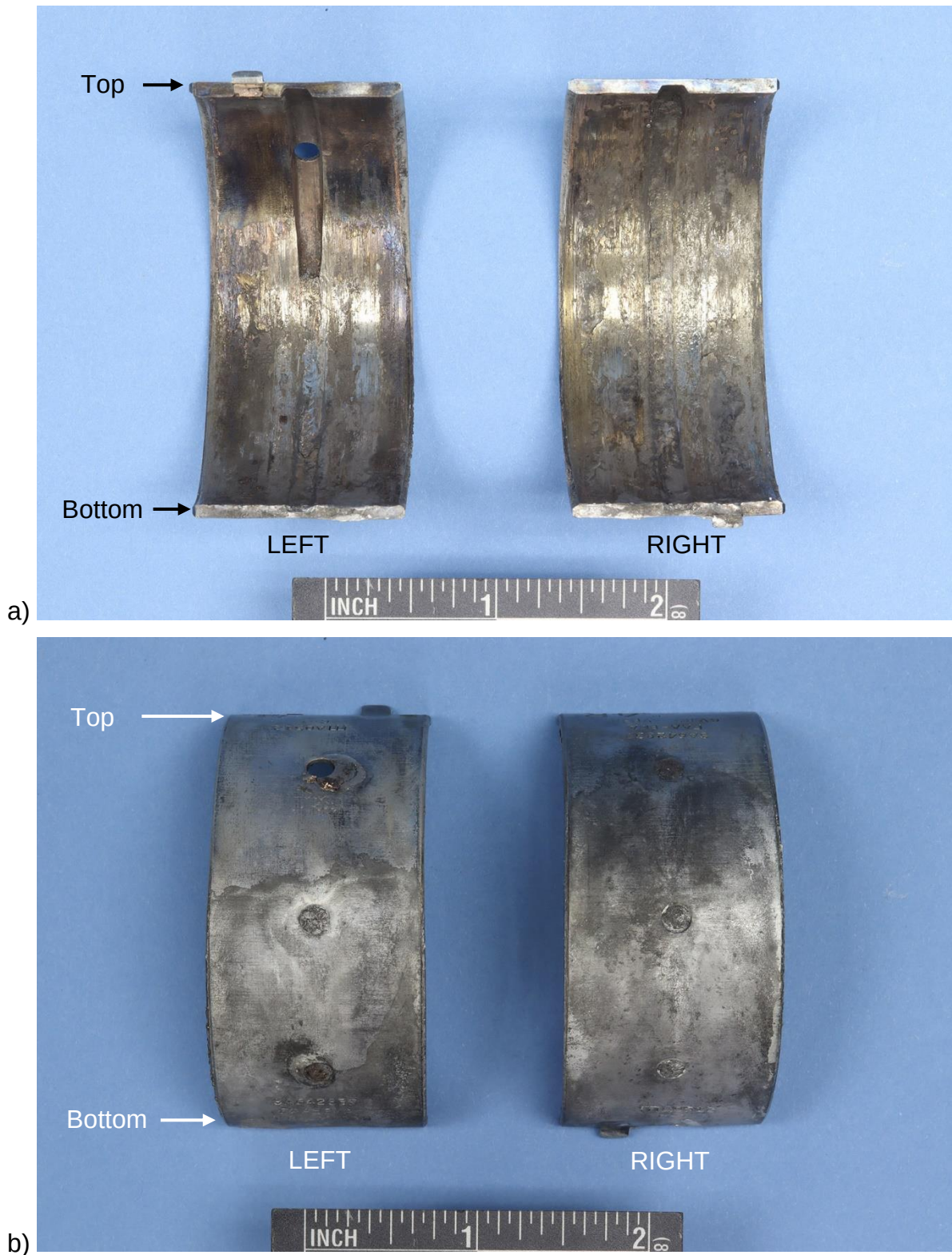


Figure 4: Number 4 main bearing inserts – a) journal-bearing sides and b) crankcase-facing backsides.

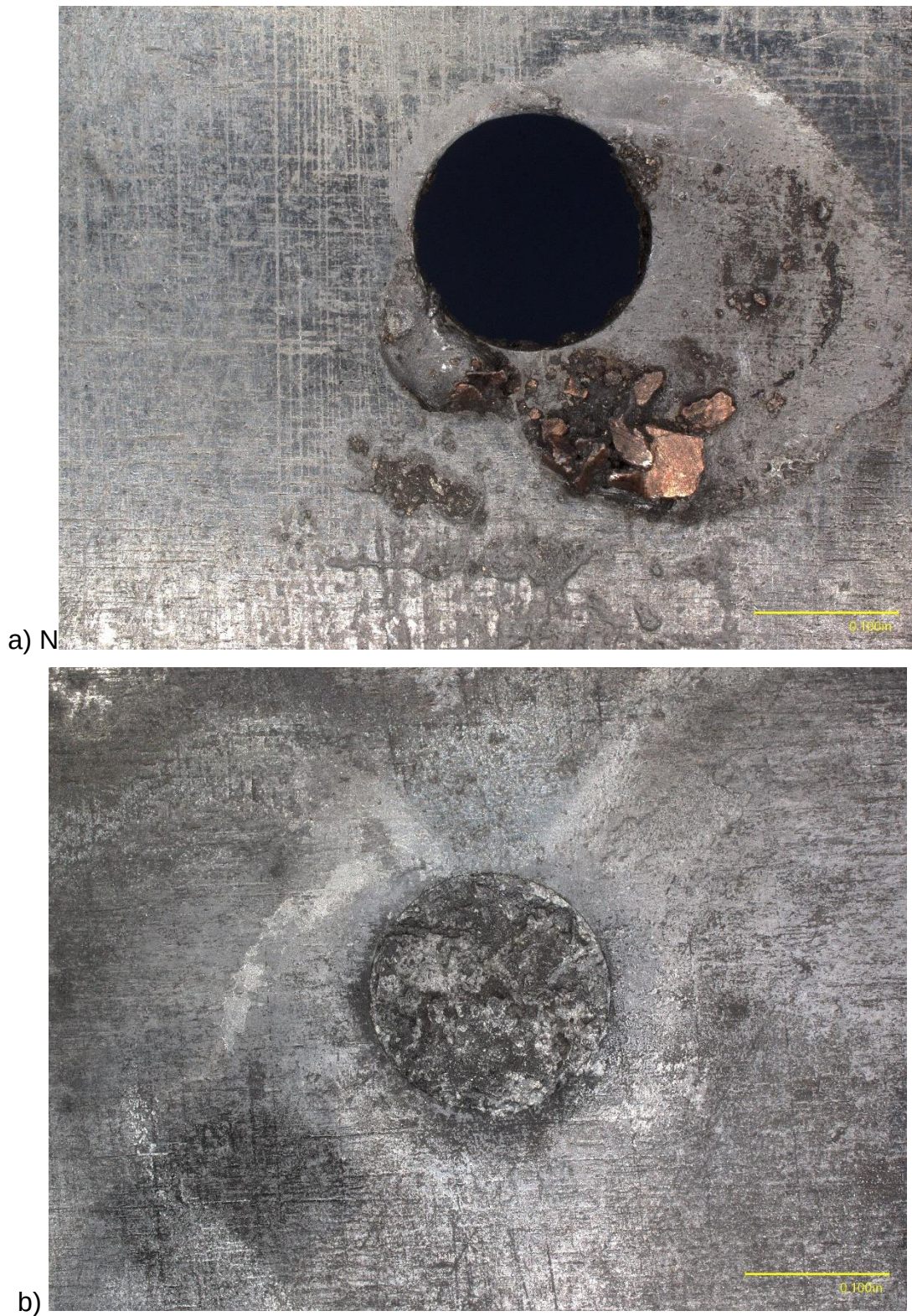


Figure 5: Oil through-holes in the number 4 left main bearing insert – a) upper hole showing solidified metal and babbitt backing material; b) middle hole – blocked;



Figure 5 (cont.): c) lower hole – blocked.

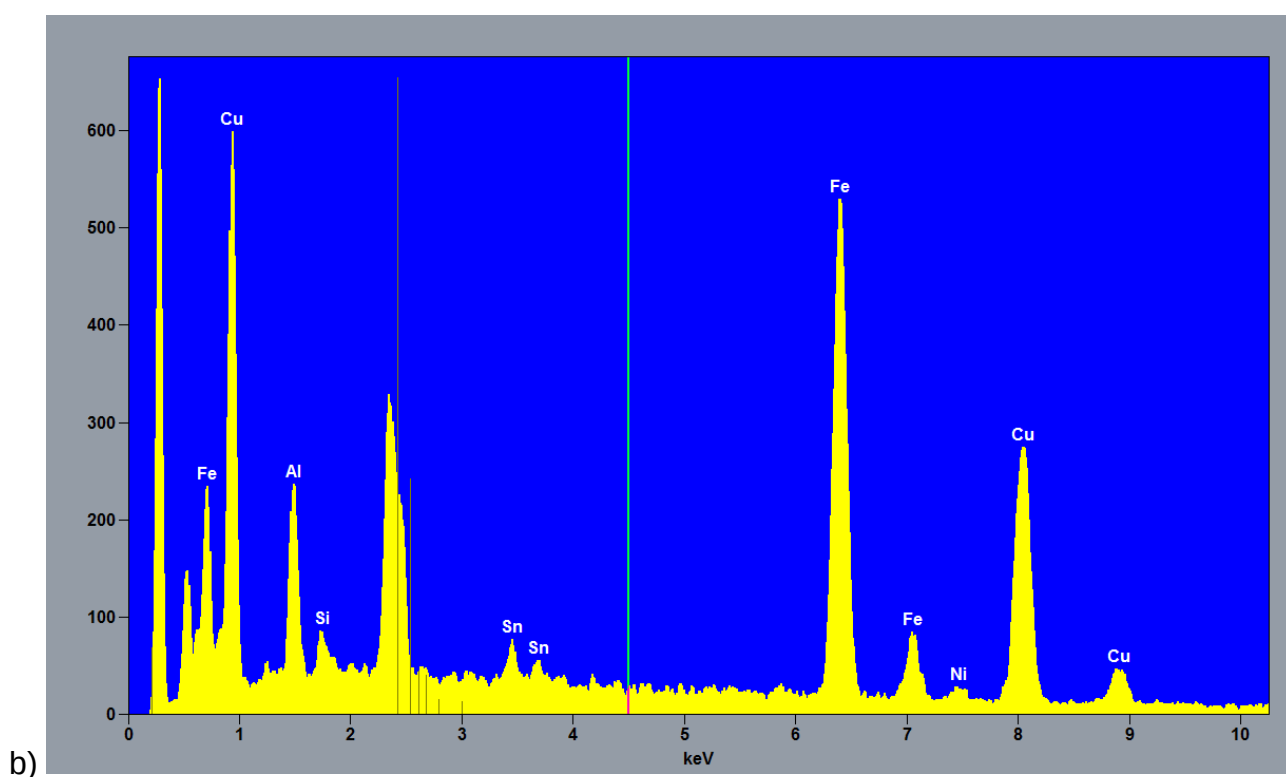
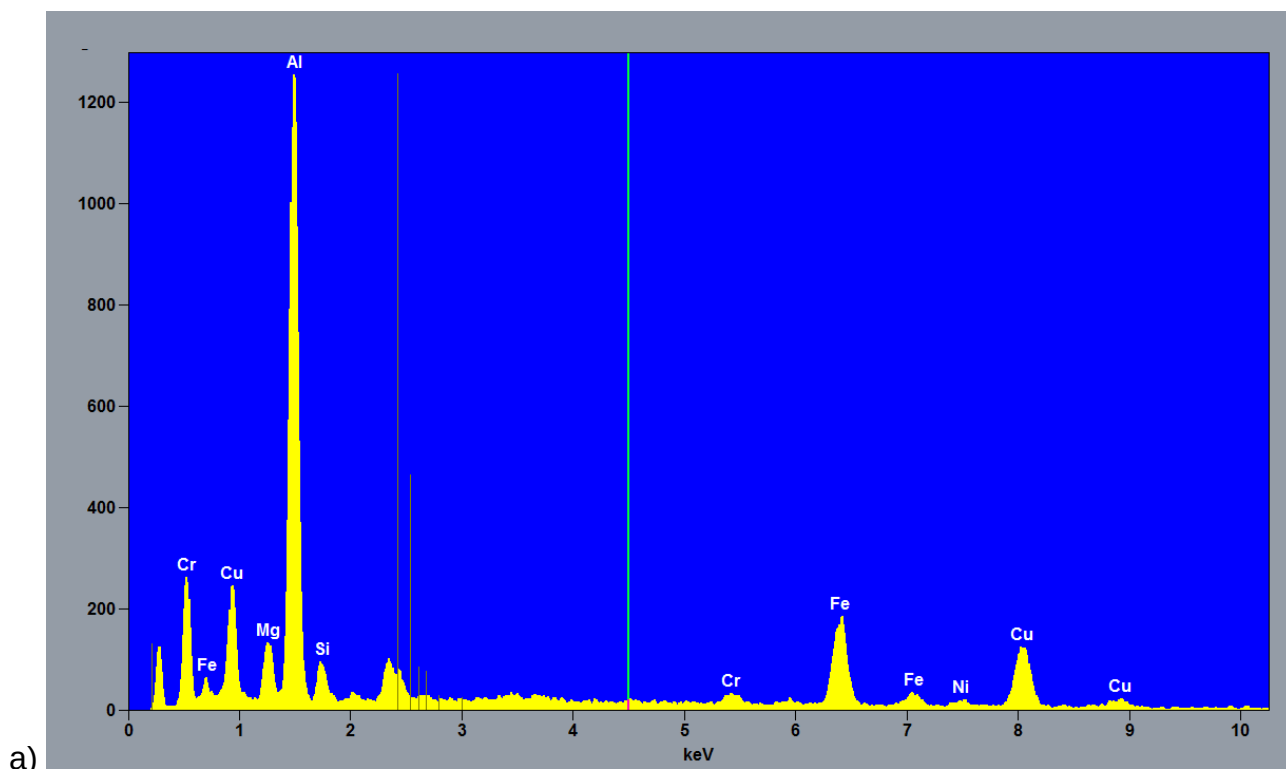


Figure 6: EDS spectra from the number 4 main bearing left insert – a) the blocked middle hole and b) the blocked lower hole.

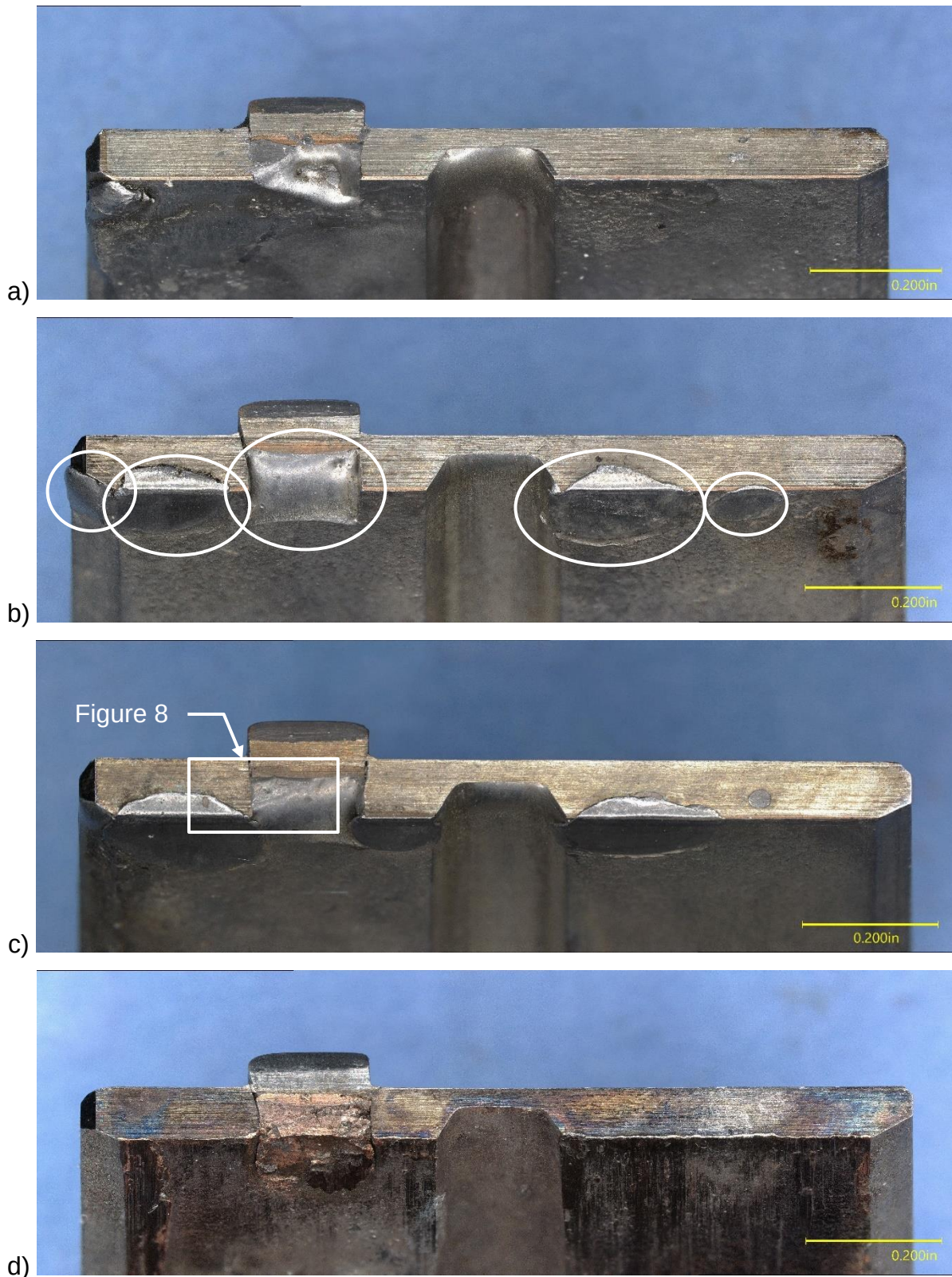


Figure 7: Upper end of main bearing left inserts showing presence of melted and resolidified metal – a) number 1; b) number 2; c) number 3; d) number 4; and



Figure 7 (cont): e) number 5.

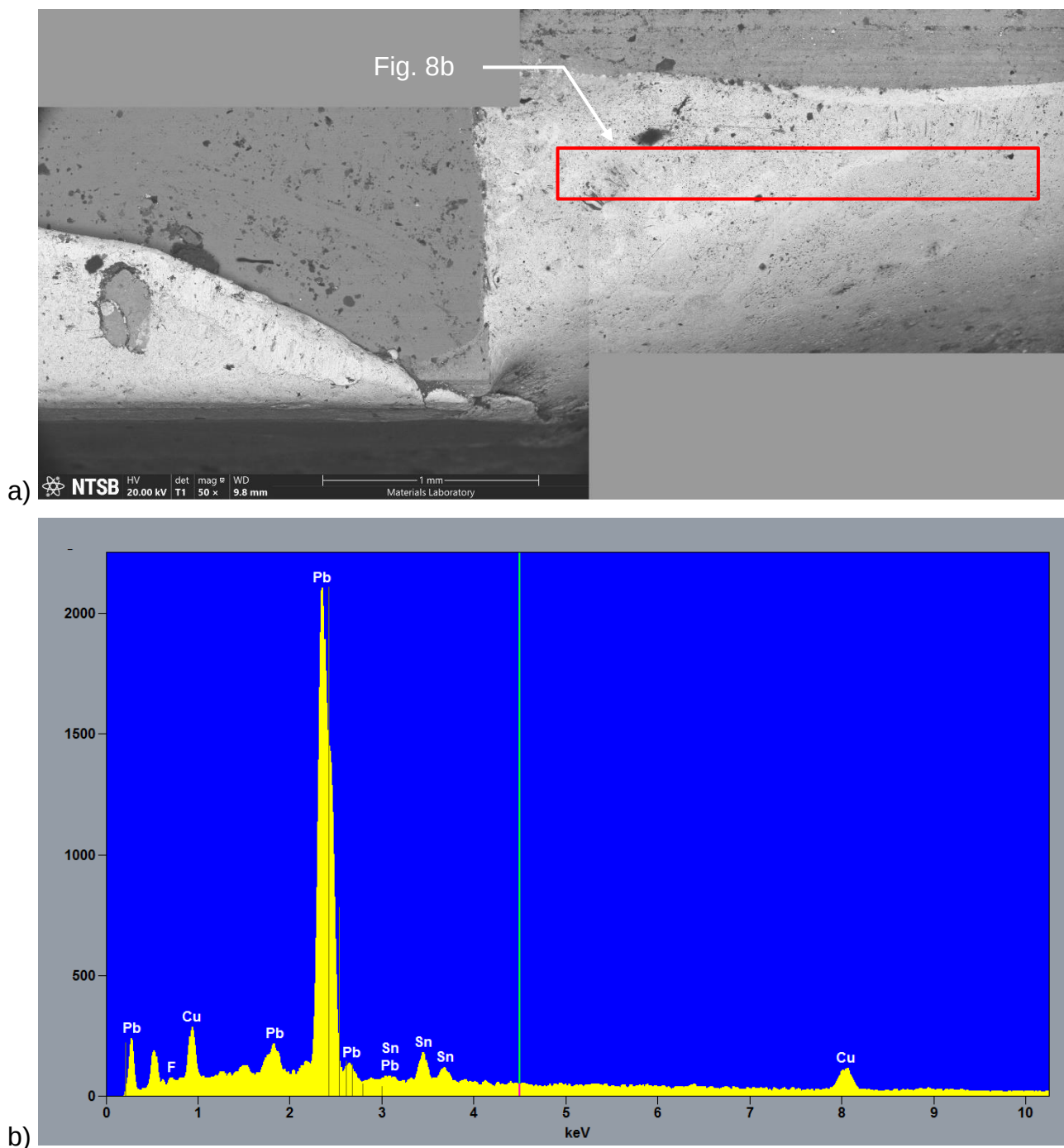


Figure 8: a) SEM image of the number 3 main bearing left insert near the tang where metal had resolidified and b) EDS spectrum of the resolidified metal showing lead (Pb), tin (Sn), and copper (Cu), consistent with the babbitt metal.