RAAD VOOR DE TRANSPORT VEILIGHEID

FINAL REPORT

96-12/A-5

G-JTCA, Piper PA23 Aztec

11 March 1996, De Kooy Airport

RAAD VOOR DE TRANSPORT VEILIGHEID

FINAL REPORT

The Dutch Transport Safety Board is an independent governmental organisation established by law to investigate and determine the cause or probable cause of accidents and incidents that occurred in the transportation sectors pertaining to shipping, civil aviation, rail transport and road transport as well as underground logistic systems. The sole purpose of such investigation is to prevent accidents and incidents and if the Board finds it appropriate, to make safety recommendations. The organisation consists of the Transport Safety Board and a subdivision in Chambers for every transportation sector which are supported by a staff of investigators and a secretariat.

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REPORT 96-12/A-5

Final Report of the investigation into the probable cause of the accident with the Piper PA23 Aztec, G-JTCA at De Kooy Airport, Den Helder, The Netherlands on 11 march 1996.

In accordance with Annex 13 of the Convention of Chicago as well as the Directive 94/56/EC of 21 November 1994 establishing the fundamental principles governing the investigation of civil aviation accidents and incidents of the Council of the European Union, the purpose of an investigation conducted under the responsibility of the Dutch Transportation Safety Board is not to apportion blame or liability.

Chairman of the Board

Chairman of the Aviation Chamber

Den Haag, May 2000

De Eindrapporten van de Raad voor de Transportveiligheid zijn openbaar.
Een ieder kan daarvan gratis een afschrift verkrijgen door bestelling bij
SDU Grafisch Bedrijf, Christoffel Plantijnstraat 2, Den Haag, via telefax nr. 070 378 9744.

CONTENTS:

Note: All times in this report are local times (UTC + 1) unless otherwise stated

APPENICES

1. GENERAL INFORMATION OF THE ACCIDENT

Place	: De Kooy Airport, Den Helder
Date and time	: 11 March 1996, 07:40 UTC
Aircraft	: Piper PA23 Aztec
Registration	: G-JTCA
Persons on board	: 1 crew, 5 passengers. No injuries

The investigation of the accident was performed by the Accident and Incident Investigation Bureau (AIIB) of the Netherlands Aviation Safety Board. The AIIB was assisted by KLM Engineering Department and the Dutch Aviation Police.

2. SYNOPSIS

During turning after landing, the left hand main wheel failed. The cause of the failure was corrosion in the collar attached to the oleostrut.

3. FACTUAL INFORMATION

The aircraft took off from Norwich (UK) on 11 March 1996 at 06:45 and arrived at De Kooy Airport in the Netherlands at 07:40. The landing runway was 04 with a wind of 100°, 18 knots. According the captain the landing was normal and the aircraft was decelerated using normal braking to walking speed. At the end of the runway the aircraft was steered to the right in preparation for a left turn to backtrack the runway. According the captain he applied full left rudder in combination with gentle braking pressure and eased the right hand engine open about half an inch forward of idle while the left hand engine was left at idle. After about 30° of turn, the fork assembly of the left main gear failed. The aircraft lurched to the left and the rate of turn increased rapidly. The aircraft came to rest after another 180° turn. The engines were stopped and the passengers and pilot evacuated the aircraft. The airports' emergency services were quickly on the scene.

The wheel with part of the fork had separated and the aircraft rested on the bottomside of the left oleo strut, the nose wheel and the right hand wheel. The two propellerblades of the left hand engine had contacted the runway and were somewhat reduced in length.

Some minor damage was incurred to the fuselage during salvage. In addition, a large dent was found on the upper side of the left hand wingtip, probably caused by a bird collision in the past.

4. INVESTIGATION OF THE FAILED LANDING GEAR

The investigation of the fracture surfaces of the broken left main landing gear was performed by KLM Engineering Department. The full report is attached as Appendix B.

The conclusions in the KLM report are:
Corrosion cracking, emanating from the bolt holes, caused the failure of the part. It is likely that the corrosion effects were triggered by galvanic corrosion between the steel bolt and the aluminum part. The lack of paint or other corrosion protection in the holes assisted in the corrosion.

5. FINDINGS

The failure of the left main landing gear was initiated by cracks in the collar attached to the oleostrut. The remaining non-cracked material in the part was not able to withstand the loads during the turn.
The collar was made of a forged aluminum alloy and contained two holes to support a steel bolt. The cracks that were found were the result of stress corrosion. It is likely that galvanic reactions between the steel bolt and the aluminum fork started the corrosion process.

6. PROBABLE CAUSE

The accident was initiated by corrosion in the collar. The corrosion started a cracking process and the forces applied to the landing gear during the turn eventually caused the collar to fail.

7. RECOMMENDATIONS

None.

REPORT 96-12/A-5

APPENDIX A

Photographs


G-JTCA

REPORT 96-12/A-5

APPENDIX B

KLM Report F132-96

Subject:

Landing Gear Failure A/C G-JTCA

To: Mr. F. Erhart
Netherlands Aviation Safety Board
Accident and Incident Investigation Bureau

1. Introduction

A part of the fork assembly from the left main landing gear from A/C G-JTCA (Piper Aztec) was submitted for investigation. The landing gear failed after arrival of the airplane at De Kooy airport (11 march 1996). Figure 1 shows a general view of the damage. Figure 2 presents a close-up of the submitted part.

2. Observations

Base Material

The material of the part was identified as forged aluminum alloy 2014, with a hardness of HRb 78 and a conductivity of 19,6 $m/\Omega.mm^2$. These values correspond with a T4 condition.

Fracture Surfaces

Figure 2 presents also a sketch of the broken part. Old cracks are present around both bolt holes. The old crack around bolt hole A (figure 3) covers nearly the full length of the part. This crack is covered by white corrosion products (typical for corroded aluminum). Bolt hole A itself shows strong corrosion pitting, with some brown deposits (most likely corrosion products from the steel bolt).

The old crack around bolt hole B (figure 4) is much smaller. Bolt hole B is relatively free of corrosion.

At several locations, the base metal grain direction (forging flow) is visible at the old fracture surfaces. Fatigue patterns were not observed. All cracking outside the old cracks is by ductile overload at the moment of the accident.

Metallographic Evaluation

A metallographic sample was prepared passing a part of the crack around hole A (in a tangential plane; see figure 2 for orientation). Figure 5 shows a sketch and several details. Heavy corrosion pitting is evident at the bolt hole. The corrosion along the fracture surface has an intergranular character. This corrosion mode can be classified as stress corrosion.

3. Conclusion

Corrosion cracking, emanating from the bolt holes, caused the failure of the part.

It is likely that the corrosion effects were triggered by galvanic corrosion between the steel bolt and the aluminum part. The lack of paint or other corrosion protection in the holes assisted in the corrosion attack.

ENGINEERING & MAINTENANCE

P.H. Alles
Metallurgical Engineer
Materials & Processes Department

Figure 1
General View of Damage

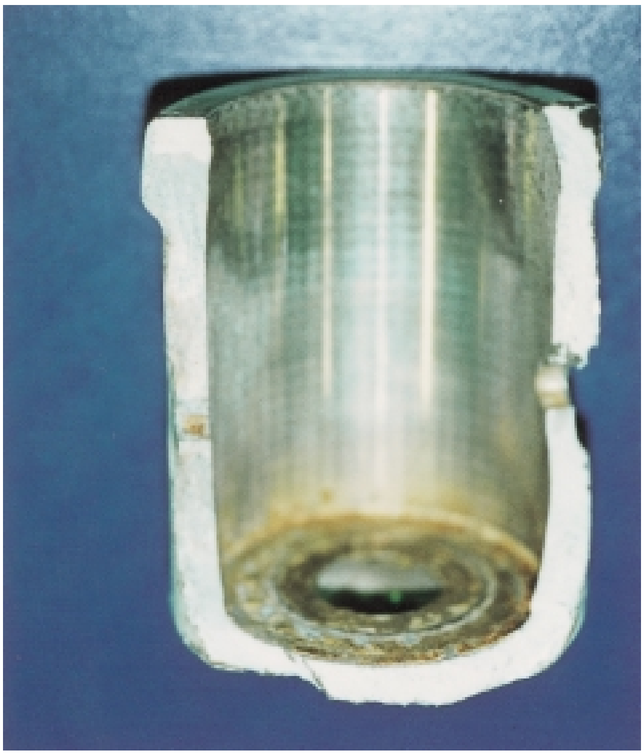
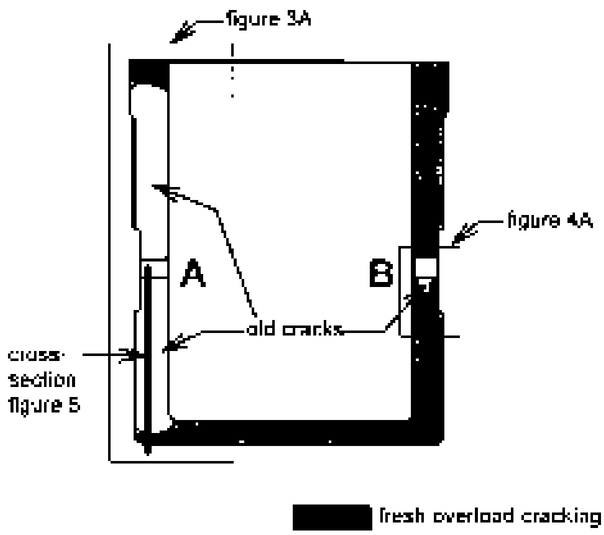


Figure 1
General View of Damage



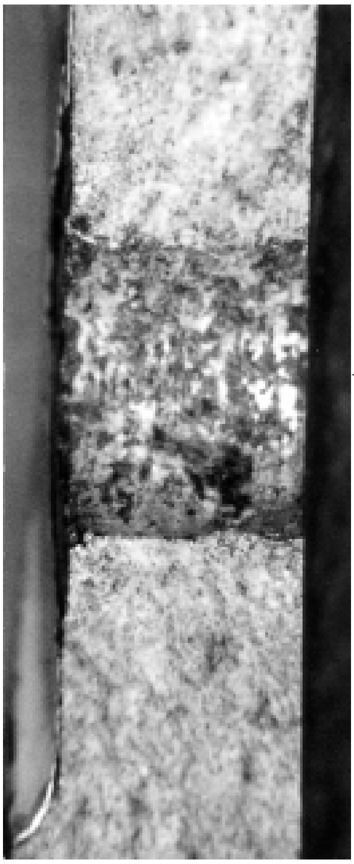
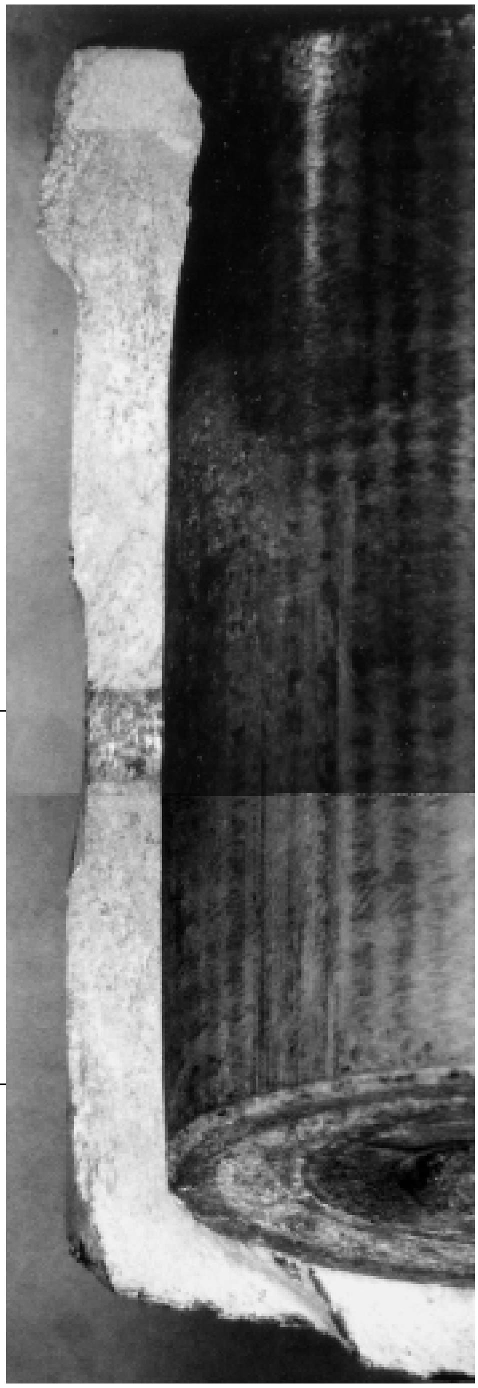


Figure 3B; magn. 6,5x

Detail around hole: note the heavy pitting in the bore.



Detail at end of old crack

Figure 3C; magn. 10x

Figure 3 Crack around Hole A

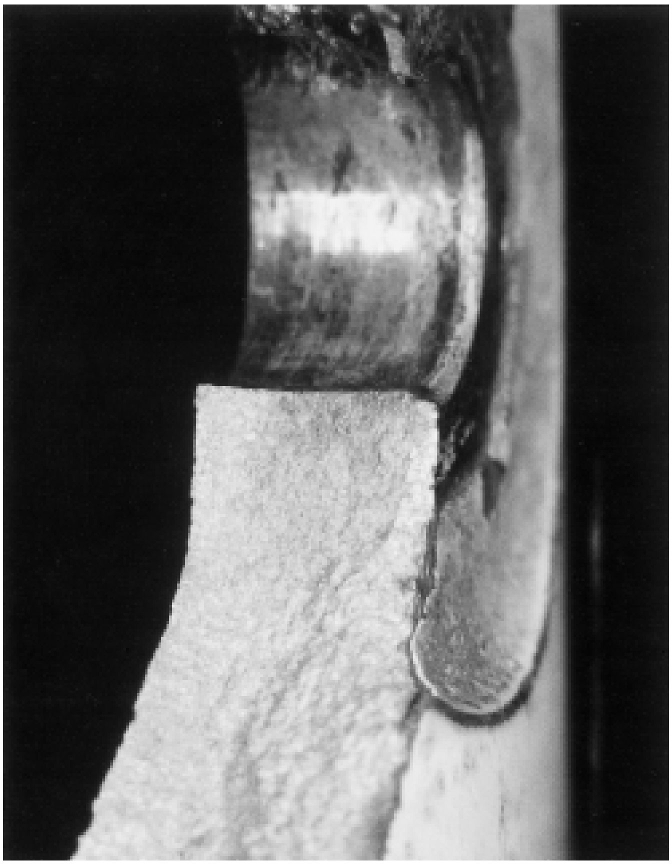


Figure 4A; magn. 6,5x
The hole itself shows only minor corrosion

Figure 4B; magn. 16x

Detail from figure 4A.

The old ”thumb-nail” shaped crack is surrounded by fresh overload cracking. The texture of the old crack reflects the forging material flow.

Figure 4 Crack around Hole B

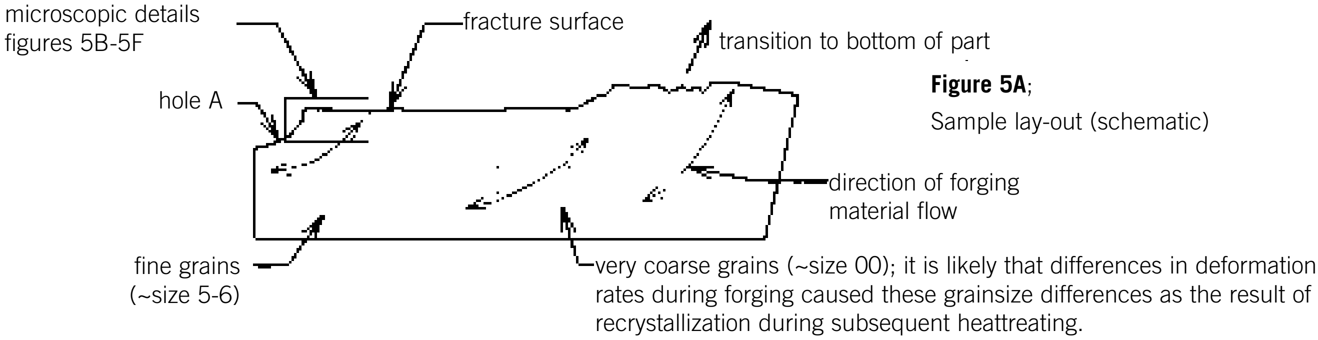


Figure 5A;
Sample lay-out (schematic)

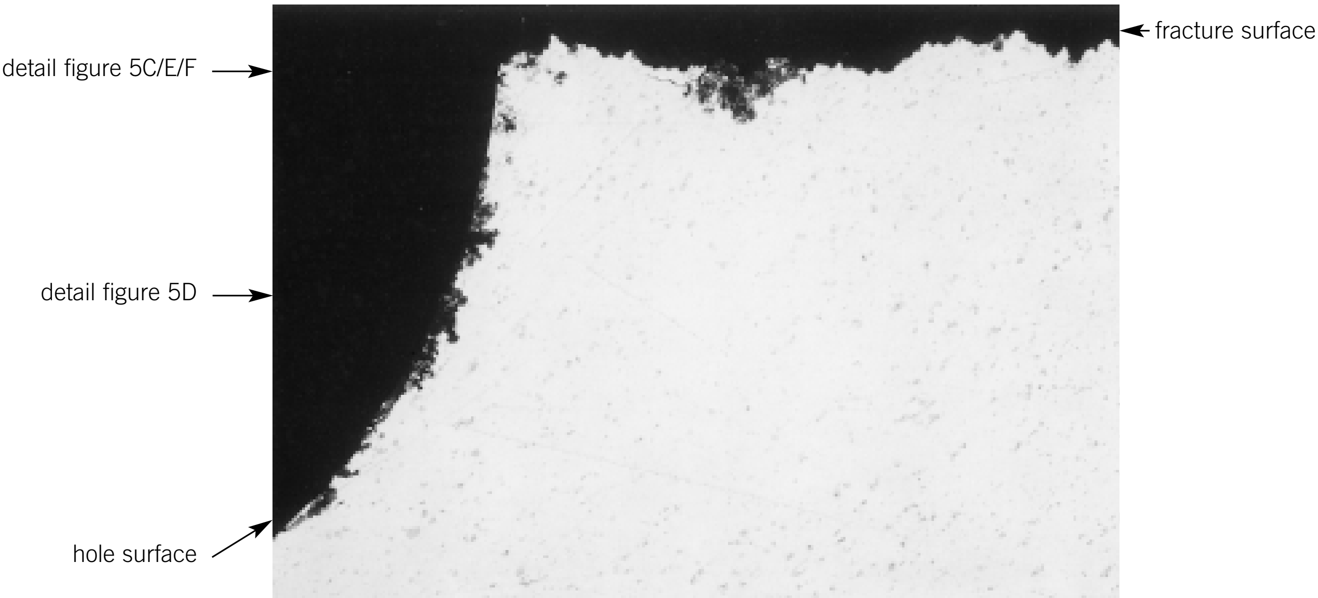


Figure 3B; magn. 31x; unetched
Note the corrosion pitting at the hole surface.

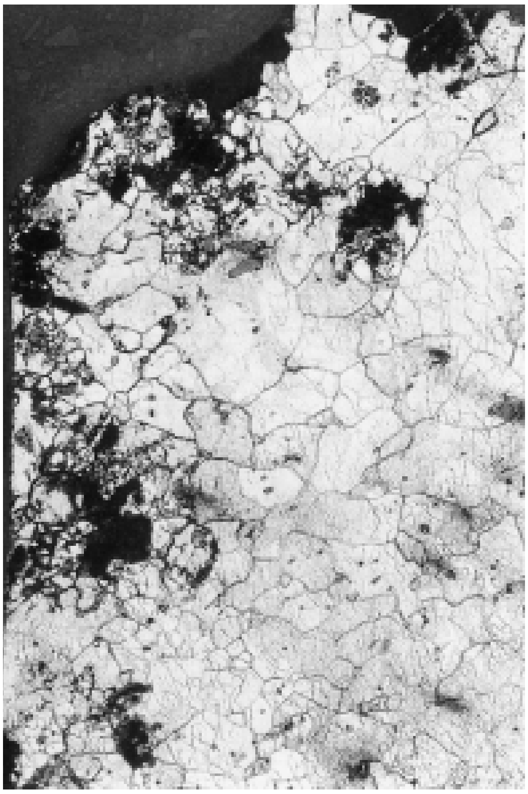


Figure 5C; magn. 200x; unetched
Detail from figure 5B (intersection of hole surface and fracture surface

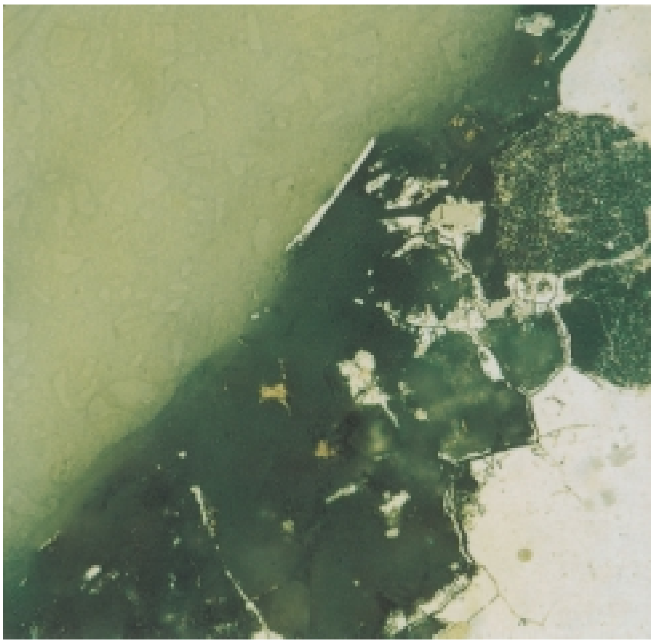
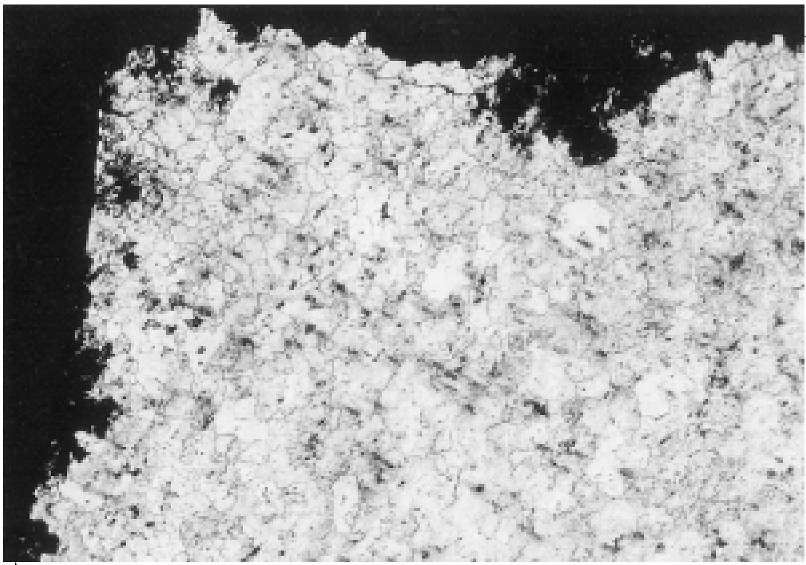


Figure 5D; magn. 500x; unetched
Detail from figure 5B
This detail shows one of the corrosion pits at the hole surface at higher magnification. Calvanic corrosion attacked the aluminum alloy was ”saved” and concentrated in copper particles. These copper particles were found at several locations were pitting occurred (both at the hole surface and at the fracture surface).

Figure 5 Cross-Section Details



fracture surface

hole surface

Figure 5E; magn. 63x; Keller's etch

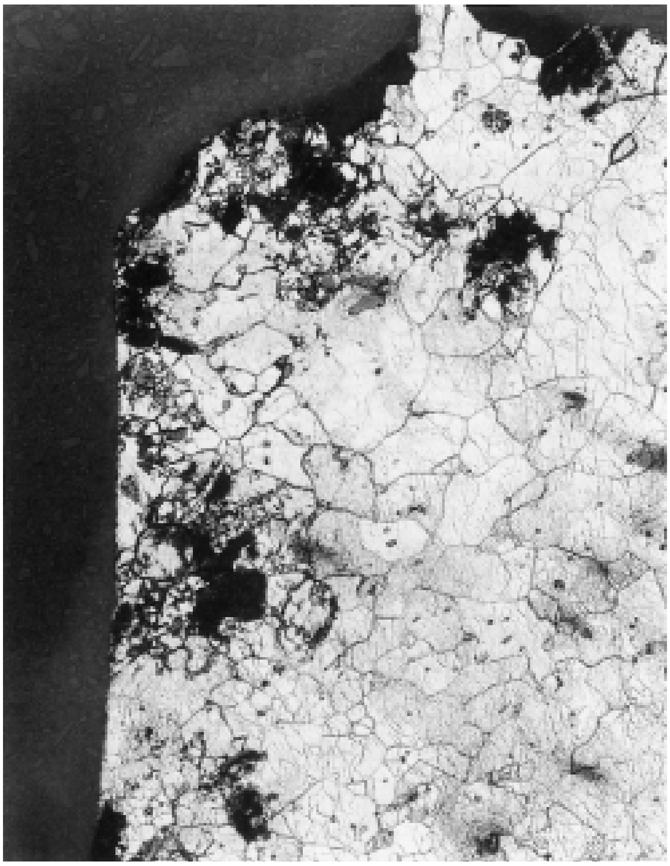


Figure 5E; magn. 200x; Keller's etch
same area as figure 5C

Figure 5 (continued) Cross-Section Details