Few quartz fragments were found scattering in the rock matrix (Figure 4.3). The quartz fragments are flattened like platelets and are approximately 50 micrometers in diameter.

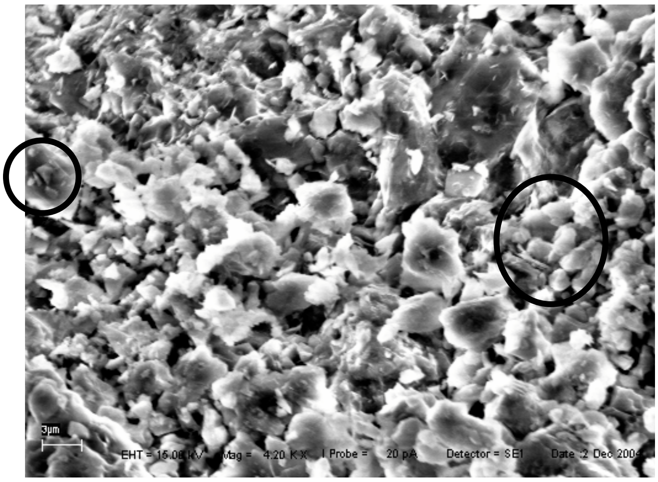


Figure 4.2 SE image of the cataclasite matrix showing angular quartz fragments and small crystals of authigenic quartz (in circles as an example)

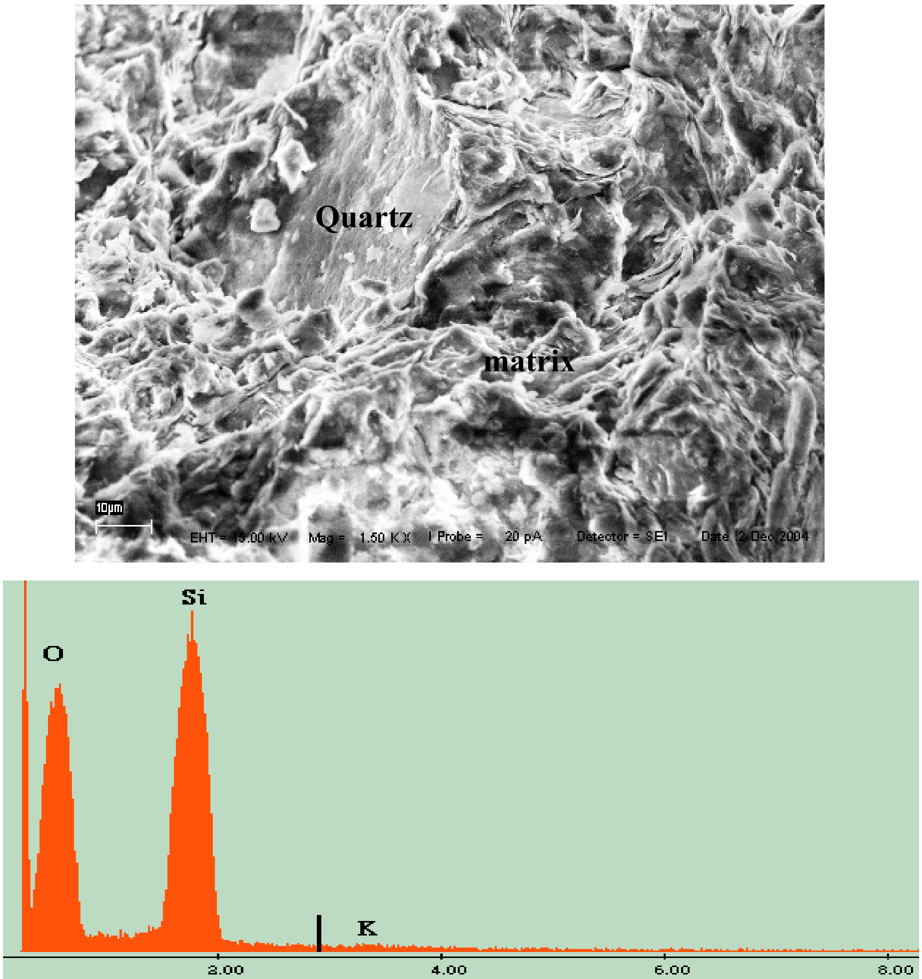


Figure 4.3 SE image showing a quartz fragment in the cataclasite matrix and the corresponding EDS pattern of the quartz

It is important to note that the composition of the quartz fragments is mostly pure silica, different from those in the matrix that contain Al and K. As mentioned in Chapters Two and Three that the cataclasite contains both rock fragments and quartz fragments as porphyroclasts. The quartz fragments did not derive form the host rock but instead from quartz veinlets cutting the host rock prior to the cataclastic process.

SE imaging and EDS analysis of a rock fragment porphyroclast in the cataclasite reveals that it has similar textural appearance and elemental composition to the matrix (Figure 4.4). The very fine fibre-like fragments are clearly deformed quartz platelets, which were probably later cemented together by silica.

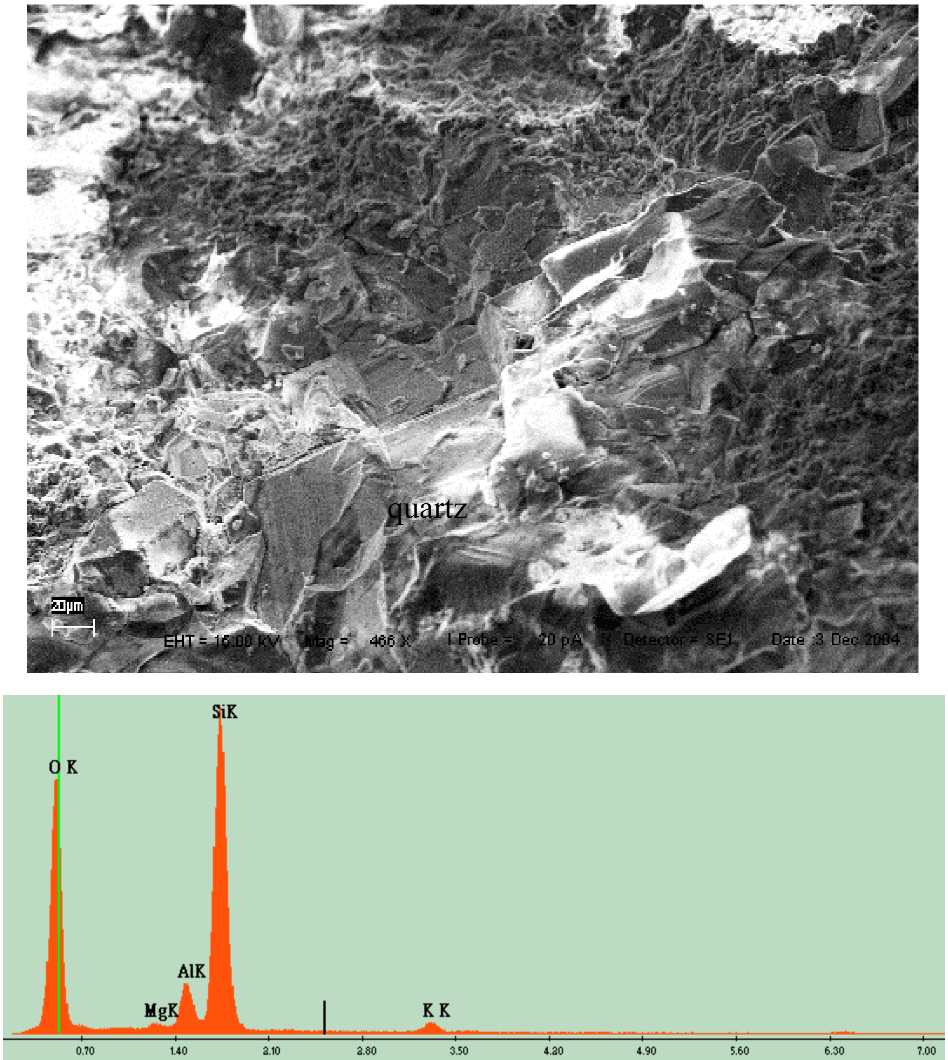


Figure 4.4 SE image and the corresponding EDS spectrum of the rock fragment porphyroclast in the cataclasite

Similar to the matrix, the rock prophyroclast also contains abundant quartz crystals (Figure 4.5). Many of the quartz grains are flattened, indicating they have been compressed in a ductile deformation. Authigenic quartz is in a form of small euhedral crystal crystallized between the quartz fragments and in cavities. The authigenic quartz is thought to have crystallized from silica dissolved from the rock itself.

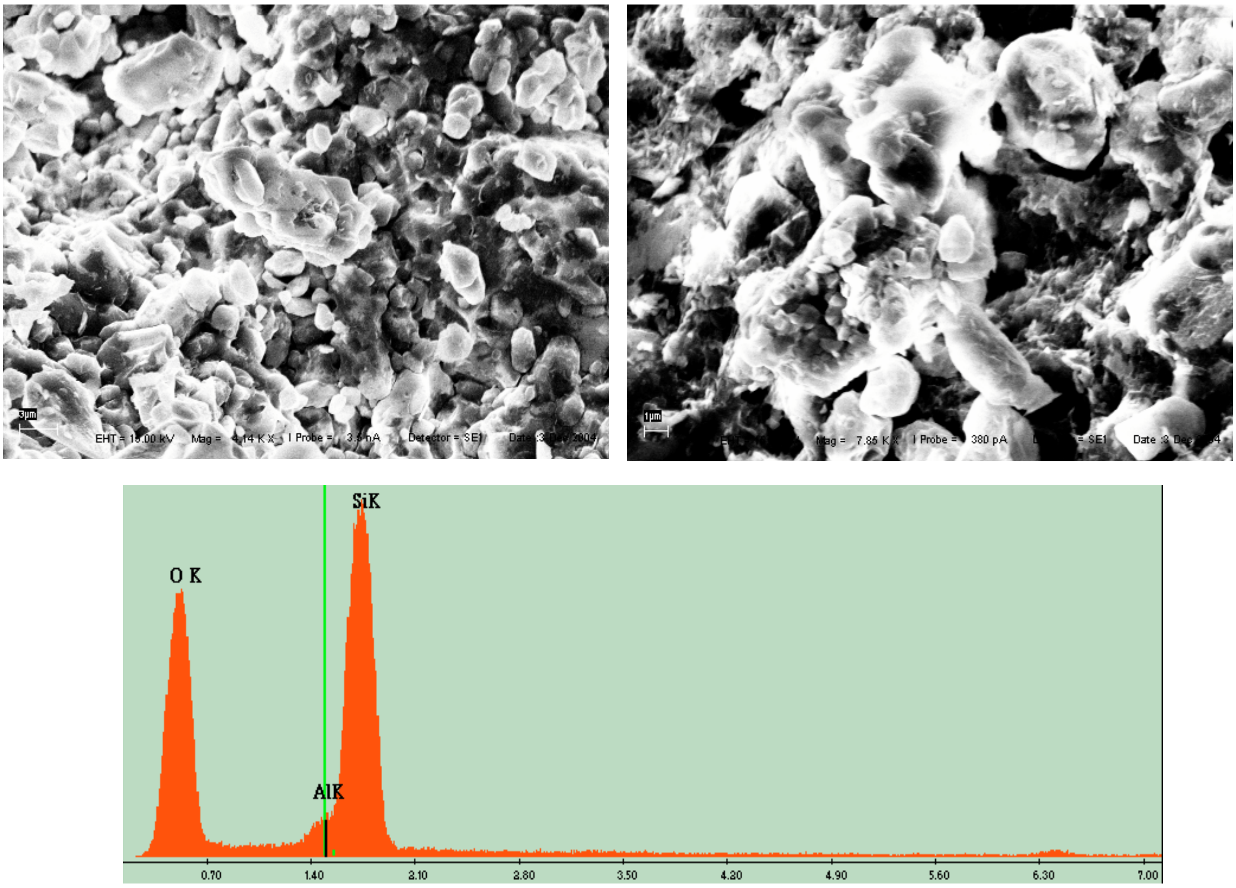


Figure 4.5 SE images and the corresponding EDS spectrum of the quartz grains in the rock porphyroclast. The quartz is flattened into platelet form.

Besides the quartz, other minerals were found to crystallize in the cataclasite matrix. Among those, pyrite is the most common mineral. Pyrite occurred as very small crystals, generally less than 1.0 mm, disseminating in the matrix. It is easily recognized by a typical cubic outline and very bright or high contrast in BSE images (Figure 4.6). Therefore the pyrite must have crystallized after the cataclasis by the reaction between sulfer transported in hydrothermal fluids with iron in the rock matrix. If it is so, the hydrothermal solution was sulfer-rich. It is noted that a high concentration of pyrite gives the rock gray to dark gray in color

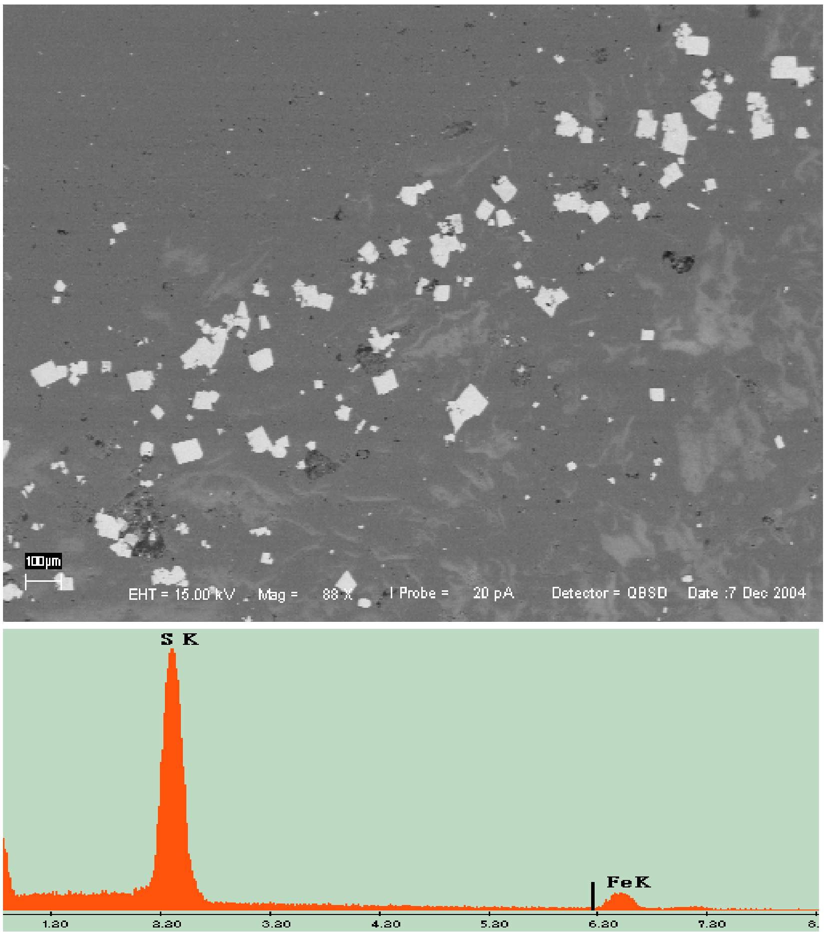
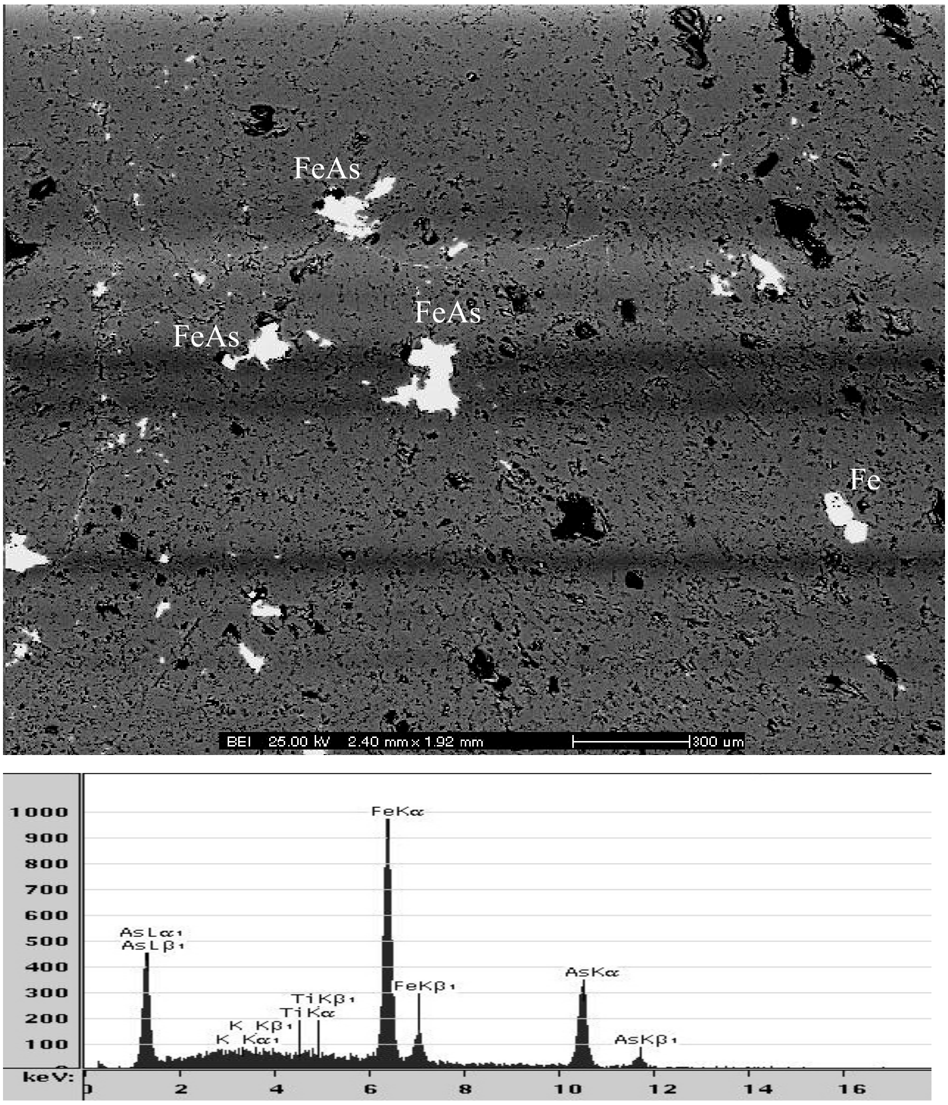


Figure 4.6 BSE image and the corresponding EDS spectrum of pyrite. Pyrite is the brightest area in the image.

In addition to pyrite, which is iron sulphide, iron arsenide mineral was also found. It exhibits similar brightness as well as crystal outline to pyrite. However EDS analysis indicates that this mineral is consisted of iron and arsenic without sulpher (Figure 4.7). This mineral could be either lollingite (FeS_2) or leucopyrite (Fe_3S_4), a rare iron arsenide compound commonly associated with pyrite and other rare metallic elements such as Au, Bi, and Te (Nurmi, et al., 1991, and Lukkonen, 1994). However the quantitative result shows that there is insufficient arsenic, as shown by the molecular ratio, to give quite the 2 to 1 ratio of lollingite and 4 to 3 of leucopyrite. The high deficiency of arsenic was probably due to the semi not full quantitative analysis and the presence of undetermined amount of other surrounding minerals. Both lollingite and arsenopyrite are tetragonal minerals and are both common as well as pyrite in hydrothermal deposit.




```
Clock Time              : 112.00 s
Channel Width           : 10 eV
Time Constant           : 40 us
Detector Type           : Standard
Comment                 :
Sample Depth            : Bulk
Sample Type             : Non-biological
Quantitative Method     : No Standards
Computation Method      : ZAF
                          Normalized
```

Element	Gross	Net	%Wt	%At Wt	K-Ratio
Fe	1148.92	1090.17	050.01	056.91	000.69
As	421.92	401.00	048.97	041.54	000.29
Ti	075.58	011.42	000.34	000.45	000.00
K	082.17	025.83	000.68	001.11	000.01
TOTAL :			100.00	100.00	

Figure 4.7 BSE image showing a distribution of iron arsenide mineral in the cataclasite matrix (shown as the brightest on the image), and a representative of the EDS spectrum and the corresponding semi-quantitative result

4.3 Analysis of the gouge

SE imaging of the fault gouge provides direct observation on fabric of the rock texture. The images in Figure 4.8 show that the fault gouge consists of mostly angular quartz fragments, most of the fragments are flattened to small platelets. This flattening feature may indicate that the deformation mechanism on the rock was both dilatancy (brittle) and compaction (ductile) behaviour. EDS analysis of the rock (most of the image in Figure 4.8) shows that the rock contains almost pure silica with minor amounts of Al and K, which is similar to the composition of the cataclasite matrix.

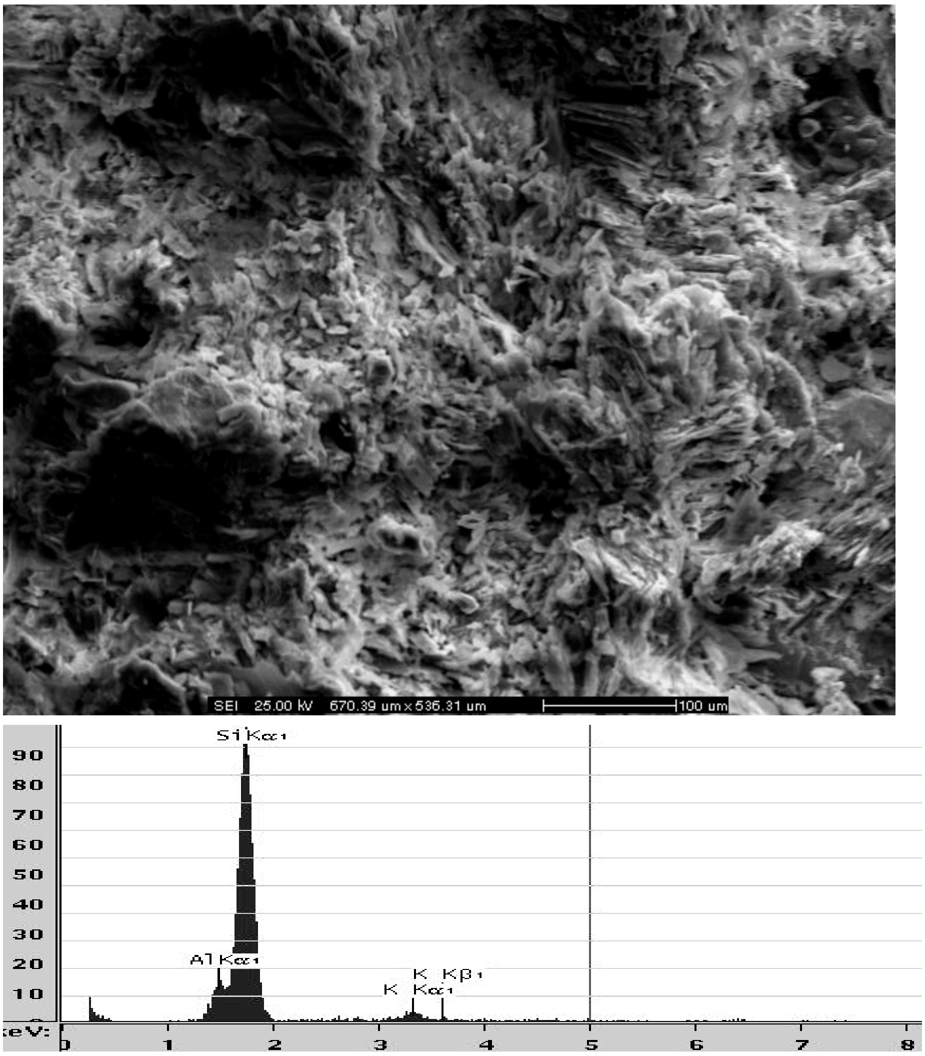


Figure 4.8 SE image of the fault gouge texture and the EDS spectrum of the matrix

Closer examination of the gouge texture shows the quartz fragments are very angular with very rugged rims. Weakly to moderately foliation of the quartz fragments are discernible. The foliation was probably an indicator of the directions of shear stress