Rapid determination of deposit-scale, temperature zonation at the San Sebastian Au-Ag deposit, Mexico from Raman spectroscopic analysis of graphitic carbon geothermometry

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Graphitic Carbon is the disordered form of graphite. It is visually similar to graphite, the pure-carbon crystalline form, but graphitic carbon contains a more disordered aromatic ring of carbon. Where graphitic carbon is subjected to high temperatures, it undergoes an irreversible graphitization process where the graphitic carbon becomes more ordered and eventually transitions to graphite. Raman spectra of graphitic carbon shows the progression of graphitization can be reliably measured and used to determine the highest temperature that a rock has experienced. Raman spectra of graphitic carbon show distinct defect peaks (D1- D4) and a single crystalline peak (G peak). For low ordered graphitic carbon where temperature is between 150 and 400°C, the peak width of the D1 peak is used to calculate the temperature. For graphitic carbon with temperatures between 400 and 650°C, the ratio of the G to D1 peak is used. In this study the temperatures of 350 shale samples, adjacent to the Au-Ag-bearing Middle, Francine, and North quartz veins of the San Sebastian vein system, were determined from Raman spectra of graphitic carbon. Temperature ranges from 201 to 306°C which agree with the fluid inclusion temperatures of the Francine and North vein. Areas with temperature greater than 275°C are considered hot spots. The results reveal hot spots that correlate to Au mineralization, which are interpreted to be zones of fluid up-flow. Thus Raman spectroscopy of graphitic carbon shows promise as a mineral exploration tool.