Fluid Inclusions in Minerals: Principles, Methodology, Practice and Applications

Civil Engineering

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Department: Others

Course Intro: : This course will be useful to Masters level students in Earth Sciences as it is an important tool of Research and will also be extremely useful for Research Scholars who want to use Fluid Inclusion techniques: â€¢ Basic concepts of what fluid inclusions are and their mechanism of entrapment in minerals â€“ types of fluid inclusions, fluid inclusion petrography â€¢ Phase relations in various fluid mixtures (H2O + salt; H2O + gases) air thermodynamic analysis in relation to entrapment of different types inclusions in diverse geological environment â€¢ Basic principles of fluid inclusion microthermometry, retrieval of temperature-pressure data from fluid inclusion microthermometric data on diverse inclusion types â€¢ Computer modeling of fluid mixtures in the context of fluid inclusion research â€¢ Applications of fluid inclusion studies in the following environments: ore formation, metamorphism and progressive deformation of rocks. â€¢ Microanalytical techniques such as IR and Raman Spectrometry, LA ICP MS and other micrbeam techniques

Pre Requisites: : B. Sc./ M. Sc. in Geology
Core/Elective: : Core
UG/PG: : PG
Industry Support : Exploration Companies

Reference : 1.Practical Guide to Fluid Inclusion Studies by Shephered, Rankin and Elderton, (1985), Blackie 2.Roedder E (1984) Fluid Inclusions. Reviews in Mineralogy, Mineralogical Society of America, Vol. 12 3.Materials will be mostly from Research Papers and Special Publications

About Instructor: I am well known in the Indian earth science circle as an expert in Fluid Inclusion Research and have contributed significantly in this field. I have developed Fluid Inclusion Laboratory at IIT Kharagpur and have been working on different types of apparatus for nearly three decades. My work on base and precious metal deposits in India involve a significant component of fluid inclusion work. I am one of the founder members of the biennial meeting of Asian Current Research on Fluid Inclusions (ACROFI) that started in 2006 and have been in the Scientific Committee of all the meetings so far. I have been a part of a DST sponsored short course on this subject and have been imparting training to Scientists in the Geological Survey of India and Atomic Minerals Directorate of Exploration and Research in India.

COURSE PLAN

SL.NO	Week	Module Name
1	1	Introduction; What are fluid inclusions and what are the mechanisms of their entrapment; Optical properties of inclusions in transmitted light, shape, size and inclusion types based on phase assemblage
2	2	Fluid inclusion petrography â€“ inclusion types and time relationship in relation to formation and modifications of host minerals, Principles of Microthermometry, heating-freezing systems and their functionalities
3	3	Aqueous fluid inclusions (H2O â€“ electrolyte), response to heating-freezing cycles, meaning of homogenization temperature, pressure corrections, plotting of isochores, plot of paired temperature-salinity data and interpretations of fluid evolution diagram
4	4	Carbonic and mixed aqueous carbonic fluid inclusions (H2O â€“ CO2 â€“ CH4) and their response to freezing-heating cycles; pressure estimation from homogenization of pure carbonic and mixed aqueous carbonic inclusions
5	5	Fluid inclusions in ore-forming environments: porphyry copper, tin, gold and skarn deposits, mesothermal gold (lode-type), volcano-associated epithermal deposits, VMS,SMS, MVT, Carlin-type gold and Uranium deposits
6	6	Fluid inclusions in diagenetic environments; Fluid inclusions in high and medium grade metamorphic rocks, characterization of metamorphic fluids, fluid characteristics in modern and ancient orogenic belts; Deformation of fluid inclusions and textures produced by ITD, IBH, IBC and ITL paths and correlation to deformation in rocks

7	7	Analysis of fluid inclusions â€“ nondestructive and destructive methods : crush leach method of bulk analysis and laser ablation masspectrometric methods for destructive analysis; Laser Raman, FTIR and other microbeam techniques of analysis of individual inclusions
8	8	Computer modeling for Fluid Inclusion data analysis and interpretations