area(s) to be surveyed, before undertaking any type of geochemical survey, as the aim of the former is to provide, at the lowest cost, the technical information on which to base the latter In an orientation survey, the following factors are to be optimized (i) optimum nature-size-character of samples, (n) best indicator elements, (m) efficacy of rock type, separated minerals, or types of material, weathering, alterations, and other variables on background and contrast of anomalies, (IV) shape, extent, homogeneity, and reproducibility of anomalies from a single site, (v) methods of sample preparation and analysis, and (vi) sources of contamination

(b) *Lithogeochemical Surveys* For proper planning of reconnaissance or detailed lithogeochemical surveys, a prior knowledge on important aspects of mineralization like type-classification of deposit sought, ore-forming processes, their patterns of both deep-seated origin and epigenetic anomalies in bedrock, major-minor-trace element haloes, and geochemical provinces and productive plutons is of much help Furthermore, studies of Pb- and S-tsotopes, and fluid inclusions in minerals of ores and rocks are important

(c) *Hydrogeochemical Surveys*- Apart from surface-, lake-, and ground-waters, drainage sediments (of spring/seepage areas, active streams, flood-plains, and lakes) can be the sampling medium For efficient usage and interpretation of hydrogeochemical anomalies, knowledge on (1) mode of occurrence of elements in and factors affecting composition of the sampling media, (n) persistence of anomalies, (in) their time-vanations, and (iv) identification of anomalies not related to mineral deposits, is essential

(d) *Pedogeochemical Surveys* In these, either residual soil or transported overburden can be used, with the anomalies of the former being more reliable as ore guides The sampling media can be weathered residuum, soils, cal-, sil-, and fem-crete, till, sand, gravel, and glacial materials These materials may be analyzed directly for the metal(s) explored for and its indicator elements, or alternatively samples of these can be panned and heavy (or sometimes light) concentrate can be subjected to mineralogical and/or chemical analysis, the latter is more effective Knowledge of (1) weathering and soil formation m different regions for optimum planning of sampling and analysis, (n) separation of significant from non-significant anomalies, and (111) distinction between lateral and superjacent anomalies to avoid costly errors is essential for these surveys

(e) *Bwgeochemical- and Geobotamcal Surveys* Biogeochemical method requires chemical analysis of plant organs like leaves, twigs, cones, wood, roots, and bark, whereas geobotamcal method requires only visual observation of plant morphology like unusual size, deformities (e g , abnormally shaped fruits, sterile apetalous forms, and stalked leaf rosette due to U-ennchment) or colours, and the distribution of plant species as a guide to buried ores, e g , *Astragalus* species m Se-nch sandstone-type U-ores Knowledge of 'uptake of mineral matter by plants' is of much help in these surveys that should become more regular, than hitherto, in geochemical exploration for U

(f) *Atmogeochemical Surveys* Use of Rn in soil-air and natural water is more efficient in locating buned U-mmeralization than of He that is relatively of large amount in atmosphere and is more useful in locating fractures and other structurally weak zones, which have important bearing on concentration of U Hence, surveys with these gases as media are to be resorted much in exploration for U

(g) *Luminescence Surveys* Luminescence, though a physical property, is due to activator elements like U, Mn, Cr, Cu, Ag, and Eu, which are present as trace/minor constituents in minerals and rocks Hence, surveys using the phenomena of fluorescence-phosphorescence, cathodoluminescence (CL), and thermoluminescence (TL) should be an integral part of exploration geochemistry, as they help in locating and predicting the unknown extensions of uramferous zones, e g , on either side of the 6 km long Tummalapalle-Giddankipalle belt, currently under exploitation by the Uranium Corporation of India Ltd, m the SW part of the Cuddapah Basin, and to separate the mineralized zones from barren ones Such surveys should precede the costly drilling

(h) *Stable Isotope Geochemistry* Apart from S, studies on other important isotopes of H, 0, and C of ores, rocks, and minerals should be routine, as they give critical information on hydrothermal U-deposits

(i) *Species Geochemistry* This, involving chemical analysis of different species of ore and gangue minerals and process-products of ore dressing operations, should be a part of exploration geochemistry It helps in bringing to light the relative concentration of U in different minerals, its distribution, impurities, and its high-value co-/by-products like Au, Ag, Cu, Ni, V, and Mo which could be recoverable during extraction of U from its ores, since as these have critical bearing on the cost-effective exploration/exploitation of U

The above suggestions, when implemented together with appropriate techniques of exploration-geology and -geophysics, will help in rapidly discovering the hitherto hidden U-mineralization as also in reducing much the cost of exploitation of even low-grade deposits by recovering high-value metals as co-/by-products during extraction of U Furthermore, establishment thus of substantial indigenous U-resources for use till the commercial operation of Th-technology will put India in a strong position so that there may not be any necessity to go in for discriminatory nuclear deals for nuclear fuel

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Ultra High Temperature Metamorphism

Ultra-high temperature metamorphism (UHT) is the most thermally extreme type of crustal metamorphism with temperatures exceeding 900°C and even up to 11 SOX UHT metamorphism has now been documented from several high grade terrains based on mineral assemblage cntena and thermometnc approach David Kelsey (Gondwana Res , v 13, 2008, pp 1-29) presents a scholarly comprehensive review of the current status of our understanding of ultra-high temperature crustal metamorphism including (1) the history of

experiments that have ultimately lead to the precise P-T constiaints on the generation of UHT mineral assemblages, (2) the diagnostic assemblages, (3) the age distribution of UHT metamorphism, (4) the use of calculated phase equilibrium to constrain the evolution ot UHT rocks, (5) overall duration of UHT episodes, (6) tectonic scenarios that have been proposed for the generation of UHT conditions in the deep ciust This paper is of great interest to metamorphic penologists, geochronologists, structuial geologists who work on the orogenic belts particularly on extieme theimal anomalies in the crust

The author provides detailed information on the history of experimental studies on the pressure and temperature stability of assemblages in the chemical systems MgO-Al_20_3-SiO, (MAS), MgO-Al_20_3-$Si0_2$-H_20) (MASH), K_70-MgO-$Al_2O_rSi0_2$-H_20 (KMASH), K_20-FeO-MgO-Al_20_3-SiO,-H_20 (KFMASH), allowing petrologists to bioadly constrain for the first time the P-T evolution ot gianuhte facies metapehtes

Mineral assemblages that are diagnostic of UHT metamorphism include saphinne-fquartz, orthopyroxene +silh-mamte+quaitz, osumilite, spmet+quaitz assemblages in pelitic compositions, garnet+orthopyroxene in Fe-nch pelites, coexistence ot orthopyroxene+augite (Mg-nch), orthopyroxene+augite+pigeonite (intermediate) and augite+pigeonite (Fe-nch) in meta-uon stones, symplectites of orthopyroxene + plagioclase in mafic granuhtes, chnopyroxene + wollostonite + scapolite grossular in calc-silicates, mesoperthites and corundum+quartz

Details of thermodynamic calculations in. coasUanuug P T evolution of rocks, have been discussed including conventional thermobaiometry, phase diagrams Recent recognition of Al-content of orthopyroxene as most effective means ot recovering peak P-T estimates as Al is relatively immobile compared to Fe-Mg during cooling have been presented The author discusses the use of pseudosections to build phase diagrams which in turn are used in quantification ot P-T-X regimes and mineral assemblage evolution in metamorphic rocks and suggests that the phase diagrams built will be useful only when integrated with petrography and mineral chemistry

Methods of estimating P-T conditions including experimentally constrained P-T grids and/or pseudosections contoured for Al in orthopyroxene and (mineral)X_{Fe} are reviewed Advantage of pseudo-sections with peak mineral assemblages ot garnet-orthopyroxene-quartz-melt and Orthopyroxene-sillimanite-quartz-melt that are useful to refine peak conditions and different P-T paths and ultimate goals m constraining the tectonic framework of gianuhte metamorphism are discussed in detail Temporal distribution of granuhte facies events including UHT metamorphism during earth history since Neoarchaean (3000-2500 Ma) and their relationship between tectonic assembly and geothermal aie reviewed Furthci, the importance ot lime-scales over which peak UHT metamorphism thiough cooling and exhumation togethei with diflcrent chronometers commonly used for placing age constraints and ditfeient tectonic models ot UHT metamorphism along with more recent view of spatial link of UHT metamorphism and supeicontinent formation aie presented The scope of future reseaich particularly integrating geochronology with metamorphic record so that P-T-t paths taken greatei meaning in the context ot earth evolution aie stressed The paper forms an important contribution for understanding the varied aspects of ultra-high temperature metamorphism

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Coastal Erosion and Siltation in Navigation. Channels- Remedial Measures and Management

One-day workshop on 'Coastal Erosion and Siltation in Navigation Channels - Remedial Measures and Management' was held in the Mangaloie University (MU) College, Mangalore on 26 Match, 2008 Inaugurating the workshop, Shn VKK Kalluraya, Dy Director General, Geological Survey of India, Mangalore, felt construction of seawalls and wave breakers, sand replenishment etc are all temporary solutions for coastal eiosion Prof KM Kaveruppa, Vice-Chancellor, MU in his presidential remarks opined that CRZ act needs to be levised and its limit should be 1500 m instead of existing 500 m Chief Guest of the inaugural lunction J Daltatri, Rtd Prof ofNITK, Surathkal and Coastal Engineering Consultant, revealed thai we are facing the erosion problem because the play ground of waves has been occupied by human beings and interfering with nature by constiucting seawalls and other structures every where According to hi in lifespan ol seawalls is only 10-20 years Leaving the shoreline as it is should be a better option, so that nature will maintain the dynamic equilibrium The workshop was organised in Kannada, as the main objective of it was to create awareness among the public and coastal community regarding the pioblems and impact ot anthropogenic activities on estuanne siltation/ coastal erosion

The topics included m the woikshop are (i) coastal eiosion m Karnataka and its piotection a survey - by J Dattati I, (n) problems and worries oi people living in the coastal zone - by Shn Upendra Hosabettu, Environmentalist, Mangalore, (in) the lole of sand dunes, salt tolerant vegetation and mangioves in containing the coastal eiosion - by K R Sndhai, Prof o(Biosciences, Mangaloie Univeisity, (iv) a study on impact ot coastal erosion in DK and Udupi districts - by K S Jayappa, and (v) shoreline changes along the Karnataka coast during the last century a study based on Remote Sensing techniques - by H Gangadhaia Bhat About 150 members including fishermen community, giam panchayat members, students and NGOs participated m the woikshop which was* sponsoied by Ministry of Eaith Sciences, New Delhi, Karnataka Bank, Mangaloie, Shankai Family Tiust, Udupi and New Mangalore Port Trust, Mangalore

The concluding remarks of the workshop are (l) it provided a unique oppoitumty for interaction and exchange of ideas between professionals in the field ot coastal studies and the local community, (n) conduct of such workshops in iutuieis necessary in order to cicate awareness on these aspects among fishermen community,