The paper discusses various models of seismicity of the Himalayan collision zone, which has always been a focus of debate on continental rheology It has been shown that earthquakes as deep as 80-90 km occur beneath parts of southern and NW Tibet, where seismicity is otherwise confined to the top 10-15 km of crust This vertical distribution of seismicity in Himalayas typify the bimodal 'Jelly Sandwich Model' More recent view suggests that the distribution of earthquakes throughout the region is consistent with generic global view of seismicity in which earthquakes occur in (a) 'wet' upper crustal material to a temperature of 350°C or (b) at high temperatures in dry granulite facies lower crust or (c) in mantle that is colder than c 600°C

The authors also discuss metastability, metamorphism and cratonization of young orogenic belts particularly in the context of Himalayan collision zone Granulite, if completely dry, can exist metastably at pressures and a temperature well beyond its normal stability limit, remains strong and retains original fabrics for hundreds of millions of years, and deforms, if at all by brittle fracture in earthquakes Water if present has dramatic effect, acting as a catalyst that allows the transformation to eclogite, accompanied by ductile deformation that removes all original fabrics The importance of these processes for the Himalayas is summarized as the foreland of India is strong and seismogenic throughout the crust as it is likely to consist of dry granulite It remains as metastable granulite beneath the 80-90 km thick root zone of the high Himalaya and southern Tibet and is responsible for the support of that elevation Further, the authors emphasize that strong lower crust of peninsular India underthrusting the Himalaya is responsible for supporting Himalayas and rheology of its underlying mantle is unimportant

Authors discuss cratonisation of young orogenic belts and should prove to be of special interest to those studying parts of the Indian lithosphere

CONJUNCTIVE USE OF SURFACE WATER AND GROUNDWATER – STATE OF ART* by S. Das

Surface water and groundwater are two phases of the hydrological cycle Development of either in isolation leads to imbalance, triggering environmental and ecological disaster So far the major and medium surface water irrigation projects in the country have not envisaged groundwater utilization Indiscriminate use of canal waters, canal seepage, return flows of irrigation together with cultivation of water loving crops, flat topography with poor drainage conditions have left large tracts in canal commands water logged with rising water table due to excessive recharge, and loss of soil fertility due to soil salinisation Paradoxically tail ends suffer from inadequacy of canal waters, resulting in overdraft of groundwater with falling water level Nearly 5 8 million hectare areas in the country are reportedly suffering from both water logging and soil salinity or alkalinity It is through management of water table or arresting its rise that the problem of water logging or soil salinity may be controlled

For optimal production, crops need requisite quantity of water at critical stages of growth But surface water supplies are often inadequate during the peak requirement Conjunctive use of surface water and groundwater not only serves as remedial measure for water logging and soil salinity, but also allows optimal use of total water resources, higher flexibility in supplies from stream flows in combination with groundwater pumpage, mixing of different quality waters to reduce salinity, and effects savings in evaporation losses from surface reservoirs, reduction in capital investments and operational expenditures, as also controls overdraft situation

Central Ground Water Board has undertaken Pilot project studies on conjunctive use in Hirakud command in Orissa, which has a cultural command area of 1, 57,018 hectares and irrigation intensity of 170% The latter was initially envisaged as 148% The average annual rainfall is 1169 2 mm The area is mainly underlain by weathered and fractured granite gneisses Detailed hydrogeological surveys, monthly groundwater monitoring, and exploratory drilling, aided by remote sensing studies and geophysical surveys, revealed that groundwater occurs under water table condition in near-surface weathered zone and circulates through underlying fractures and fissures Three to four water saturated fracture zones are encountered in boreholes within a depth of 100 meters Water logging condition (depth to water < 2 meters from surface) prevails in an area of 163 square kilometers during pre- monsoon (May 1994) and 7264 square kilometers during post monsoon periods (November 1994) The envisaged cropping pattern in the project included paddy cultivation of 68% in kharif and 30% in rabi seasons, which to the contrary is practiced as 98% and 68% respectively, leading to over use of canal water and excessive recharge to groundwater The crop yield of around 20 quintals per hectare in this irrigation command is far below all India average due to mainly lack of water management and water logging The discharge and specific capacity of dug wells ranged from 4-11 LPS and 0 012 – 0 041m^3/min/m respectively The yields of borewells and cumulative transmissivity of fractured rocks are in the range of 5-10 LPS and 9-134 m^2/day respectively

The utilizable groundwater resources in the kharif season were estimated as 508 million cubic meters (MCM) and in rabi season as 764 MCM, following methodology of GEC97 Monthly availability of groundwater resources, computed from well hydrographs included dynamic, potential and static resources available within a depth of 5 meters In order

* *Karanth Endowment Lecture delivered on 28th December 2007 at the Geological Society of India, Bangalore*

to rectify water logging the water table needs to be lowered down to 5 meters depth The annual availability of surface water in kharif is 1360 MCM and in rabi 1494 MCM as computed from the canal discharges To optimize use of the available water resources and to maximize crop production and return from irrigation, along with reduction of water logging, several scenarios were generated by system analysis and mathematical modelling cum simulation studies

1 Only canal water usage with no groundwater draft and with existing cropping intensity of 170% Computed shortage of water is fully met from the regeneration of canal waters But the water balance after predictive simulation shows increase in groundwater storage from 169 to 1228 MCM over a period of five years In the outflows values of evapotranspiration are found to increase showing progressive shallowing of water table

2 For conjunctive use scenario an optimization of cropping pattern was attempted for maximum use of surface water in conjunction with groundwater with 200% cropping intensity The cropping pattern in kharif season was contemplated as paddy 98% and sugarcane 2%, and the shortage of water might be met from groundwater In rabi season crop diversification was attempted through system analysis using linear programming technique

The resultant cropping intensity in various sectors in rabi was taken as Paddy 38-35%, Pulses 36-18%, Oil seeds 12-19%, vegetables 10-12%, sugarcane 2% Accordingly monthly water demand was calculated following a climatological approach With surface water use of 70% and groundwater 30% the post- monsoon water table declined from the prevailing 1 2 meters to 1 9 meters The construction of additional 17526 energised dug wells may achieve the conjunctive use objectives in the area

The study clearly shows that substantial scaling down of surface water irrigation combined with groundwater use may eliminate water logging along with increase in irrigation intensity and agricultural production through crop diversification However this may need well construction and energisation to be borne from public funding sources like surface irrigation projects

THE ORIGIN OF ALKALINE LAVAS

An interesting paper on the origin of alkaline lavas has appeared in *Science*, v 320, pp 883-884 by Yaoling Niu The author highlights the origin of alkaline lavas on the ocean island by melting of metasomatic amphibole-rich veins that form in oceanic mantle lithosphere as it ages He also suggests that such melts in the presence of CO_2 are of kimberlitic composition, which according to the author offers new perspectives on the origin of continental alkaline magma association – *Ed*

CORRIGENDUM

Readers are requested to note the change in GSI Type nos mentioned in papers "Cyclostome Bryozoa from the (Eocene) Lutetian of western Kachchh, Gujarat by Asit K Guha and K Gopalakrishna", Jour Geol Soc India, v 69, June 2007, pp 1271-1278 and "New Calloporid (Bryozoa, Cheilostomata) species from Tertiary Sequences of Western Kachchh, Gujarat by Asit K Guha and K Gopalakrishna", Jour Geol Soc India, v 70, July 2007, pp 121-130

JGSI, v 69, p 1272, col 2, 11th line from top	*Stomatopora illiesae* n sp	21262 in place of 21162
JGSI, v 69, p 1274, col 1, last line	*Voigtopora reticulata* n sp	21263 in place of 21163
JGSI, v 69, p 1275 col 1, last line	*Discosparsa lakhpatensis* n sp	21258 in place of 21158
JGSI, v 69, p 1276, col 1, first line	*Idmidronea* sp	21257 in place of 21157
JGSI, v 69, p 1276, col 1, 5th line from bottom	*Oncousoecia narediensis* n sp	21259 in place of 21159
JGSI, v 69, p 1277, col 1, first line	*'Proboscina'* sp	21261 in place of 21161
JGSI, v 69, p 1277, col 1, 12th line from bottom	*Plagioecia taylori* n sp	21260 in place of 21160
JGSI, v 70, p 122, col 2, first line	*Aplousina* sp	21264 in place of 21164
JGSI, v 70, p 123, 18th line from bottom	*Copidozoum feddeni* n sp	21265 in place of 21165
JGSI, v 70, p 123, col 2, last line	*Crassimarginatella blanfordi* n sp	21266 in place of 21166
JGSI, v 70, p 124, col 2, 21st line from top	*Crassimarginatella ukirensis* n sp	21267 in place of 21167
JGSI, v 70, p 127, col 1, 6th line from bottom	*Marginaria senguptai* n sp	21268 in place of 21168
JGSI, v 70, p 128, col 1, 8th line from top	*Planicellaria kharaiensis* n sp	21269 in place of 21169
JGSI, v 70, p 128, col 2, 13th line from top	*Planicellaria naliyaensis* n sp	21270 in place of 21170
JGSI, v 70, p 129, col 1, 19th line from top	*Reptoporina chhasraensis* n sp	21271 in place of 21171

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