

प र व नि समाचारपत्र A M D NEWSLETTER



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परमाणु स्वनिज अन्वेषण एवं अनुसंधान निदेशालय का अर्ध-वार्षिक प्रकाशन

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SOME EXPLORATION EFFORTS FOR NUCLEAR RAW MATERIAL IN PRECAMBRIANS OF NORTHWESTERN, CENTRAL AND EASTERN INDIA

R.K. NAGAR



Shri R.K. Nagar obtained his M.Sc. (Geology) from University of Jammu & Kashmir in 1965. He joined AMD in September, 1967. He was Regional Director of Northern Region and attained superannuation on 31.10.2004.

Aravalli-Delhi fold belt in Northwestern India is one of the oldest orogenic belts of the Indian Shield, comprising thick accumulation of shelf and deep water sediments with sporadic occurrences of granitic, mafic and ultramafic rocks. Udaipur-Jharol linear belt in south Rajasthan may be considered as a type area of Early Proterozoic linear basins which overlie the Banded Gneissic complex (3000-2500 m.y.). The Proterozoic Delhi Super Group forms the spine of the Aravalli fold belt in northern India while Erinpura

granite covers the entire span of Delhi orogeny. The basin margin with the Aravalli belt mark the palaeosutures such as Rakhab Dev lineament, Kaliguman lineament and others. The development of large oceanic basins is characteristic of the Aravalli-Delhi fold belt - the basins formed as a result of ductile extension of hot sialic material followed by crustal contraction. The large scale ensialic orogenesis involved the reworking of the granitic - gneissic complex as well as the Platformal Sediments - producing mobilised basement in the western Indian shield. The Pre-Cambrians of Central India consist of Bundelkhand and Bastar craton, characterized by Proterozoic sedimentary basins of Vindhyan, Gwalior, Bijawar, Chhattisgarh etc. Crustal scale shear zones separate the cratons from the mobile belts.

URANIUM AND RMRE EXPLORATION: In mid-fifties, the requirement of uranium and rare earth and rare metals for the nuclear energy programme of the country necessitated multipronged exploratory efforts including airborne radiometric surveys in the Aravalli-Delhi belt and Singhbhum - Orissa craton. AMD launched a comprehensive programme for the exploration of nuclear raw material. Two significant discoveries were made in the late fifties. The one at Umra-Udaisagar (Udaipur district, Rajasthan) in Aravallis and the other at Jaduguda (Singhbhum district, Jharkhand) in Singhbhum group of rocks.

I joined AMD in 1967 and participated in the exploration activities beginning with the exploration for RMRE bearing pegmatites in Rajasthan and Gujarat. The results of such efforts were published by AMD in a special volume on Rare Metal and Rare Earth pegmatites of India, EARFAM, Vol.12, July, 1999.

I had the privilege to work for more than three and a half decades in the Pre-Cambrian

of Rajasthan, Gujarat, M.P., U.P., Jharkhand, West Bengal and Orissa under the guidance of stalwarts of AMD. Mention may be made of S/Shri G.R. Narayan Das, T.M. Mahadevan, D.N. Chaube, A.C. Saraswat, Rajendra Singh, D.S. Sharma, B.S. Negi, G.S. Bhatnagar, Ravi Kaul, T.N. Parthasarathy, K.K. Sinha, D.V. Katre, Jagmer Singh, S.P. Hingoraney, P.C. Taneja, Govind Singh, B.M. Swarnkar, R.M. Sinha, R.K. Gupta, and A.K. Bagchi. It was very interesting to have worked with Shri D.B. Sen, though for a few years in Himalaya and Gwalior/Bijawar basins. I can recall the memories of the 1983-84 field season in Pokhri area in Uttaranchal when we both were stuck up for 72 hours in a small hut surrounded by thick cover of snow.

The experience gained by me in close association with the veterans of AMD helped me to identify significant uranium horizons in different geological environments. Mention may be made of NE extension of Umra, district Udaipur, Rajasthan, hosted by calc-phyllites and carbon phyllites, the aplites / alaskites (now identified as albitites) in Northern Rajasthan, and the uraniumiferous Quartz pebble conglomerate (Q.P.C.) in Sarara Inlier, South Udaipur. The above finds of mid-eighties have now revived the interest of AMD to explore for Q.P.C. hosted and unconformity related uranium deposits in Proterozoic sedimentary basins of India.

In Umra-Udaisagar-Kalamagra belt (Udaipur), significant uranium mineralization is confined to the faulted and sheared contact of carbon phyllite/impure limestone with carbonaceous shale of Aravalli Supergroup. The major shear trending NE-SW between Umra Mine and Umra village extending further upto Lakadwas and then to Kalamagra need extensive exploration. The parallel shear about 2 km east of Umra Mine passing through 'Khan Magra' old copper working having similar lithostructural set up as that of Umra-NE, also warrant special attention requiring especially lithochemical and drilling inputs.

There is a vast expanse of Proterozoic terrain for the exploration of uranium, base metals and REEs in North Delhi fold belt such as felsic volcanics and granites of Tosham, Jhunjhunu and Udaipur wati which fall along a deep crustal lineament along the western flank of the Delhi Mobile Belt.

HELIUM EXPLORATION : I had the opportunity to participate in the exploration programme of AMD for the estimation of Helium in the thermal fields located along the northern periphery of the Gondwana Basin in parts of West Bengal and Bihar. This was a coordinated effort of AMD with IACS and VECC, Kolkata, where AMD participated for 2 years. The thermal field of Bakreshwar - Tantloi is a potential source for large scale helium exploitation. The work of AMD has been documented in "Geothermal Energy in India", GSI Spl. Publ. 1996, Vol.45, pp 349-359. This was really an interesting assignment. Seeing the national requirement for Grade-A Helium in advanced technological programme the other sources such as natural gas reserves may be looked for the extraction of helium. AMD has got the expertise in the extraction and purification of helium from thermal springs gases which may be utilized for the extraction of helium from the available natural gas resources in the country.

The Department, over a period of time since its inception, has attained maturity with state-of-the-art infrastructural facilities and has produced excellent team of scientists. The scientists have attained sufficient expertise in different fields and can cope up with the exploration and exploitation of atomic minerals. **I wish for the bright future of the Department and extend my sincere thanks to all my colleagues for their support and cooperation for the discharge of my duties.**

FIVE DECADES OF GEOPHYSICS IN AMD

K.L. TIKU

Geophysical techniques in AMD is an integral part of uranium exploration programmes. Radiometric techniques have the advantage of direct detection in uranium exploration, but the depth factor is extremely limited. Non radiometric geophysical methods are therefore an indispensable component of uranium exploration. The specific techniques used depend upon the nature of mineralisation, characteristics of the host rocks, structures and the physical properties of the associated minerals. Self Potential (S.P.), electrical resistivity, induced polarisation (I.P), electromagnetics (EM) and magnetic methods are employed wherever uranium deposits are structurally controlled or are associated with sulphides, graphite and magnetite.



Shri K.L. Tiku obtained his M.Sc. (Applied Geophysics) from Indian School of Mines, Dhanbad in 1968. He Joined AMD in January, 1973. He was Incharge, Exploration Geophysics Group and attained superannuation on 31.10.2004.

Similarly gravity and seismic methods have been found useful in delineating granitic bodies and configuration of sedimentary basins while working for sandstone type of uranium deposits. The electromagnetic techniques using time and frequency domain, Induced polarisation (time, frequency and spectral), and potential field measurements have been successful for locating base metals, sulphides and associated mineralisation, mapping structures associated with and controlling such mineralisation and mapping alteration zones, clay horizons, graphitic

zones and fault breccia. These methods not only recognise the environment for uranium mineralisation but also locate the mineralised zones by their diagnostic physical properties.

The ground geophysical investigation in AMD for uranium exploration started in 1959-60 with one geophysicist and few physicists as the nucleus. The instruments used were Torsion balance magnetometer, SP meter and Gish-Roony resistivity meter. The interpretational techniques during those period were qualitative and laborious. In 80's a new phase in geophysical activity was started by recruiting trained geophysicists and procuring new generation geophysical instruments. These instruments include Time and Frequency Domain Induced Polarisation System, Frequency Domain Electromagnetic System (TURAM), proton precession magnetometers and gravimeters. In 90's more sophisticated microprocessor based, battery operated geophysical instruments were acquired. These instruments are light weight, more sensitive, rugged, have high quality data acquisition system and are user friendly. The instruments added were Transient EM system, Integrated geophysical system with capabilities to measure IP, VLF and EM, high sensitivity proton precession magnetometers with memory and auto recording facility. IGS-IP system is an improved version of old IP receiver with 14 measuring gates and uses in-built software EPROM and calculates all the IP parameters and data can be dumped to a PC. These parameters can be used to discriminate the grain size of the polarisable material eg. sulphide, graphite, magnetite etc. It is most effective in the geological structures where uranium mineralisation is associated with carbonaceous matter like graphite.

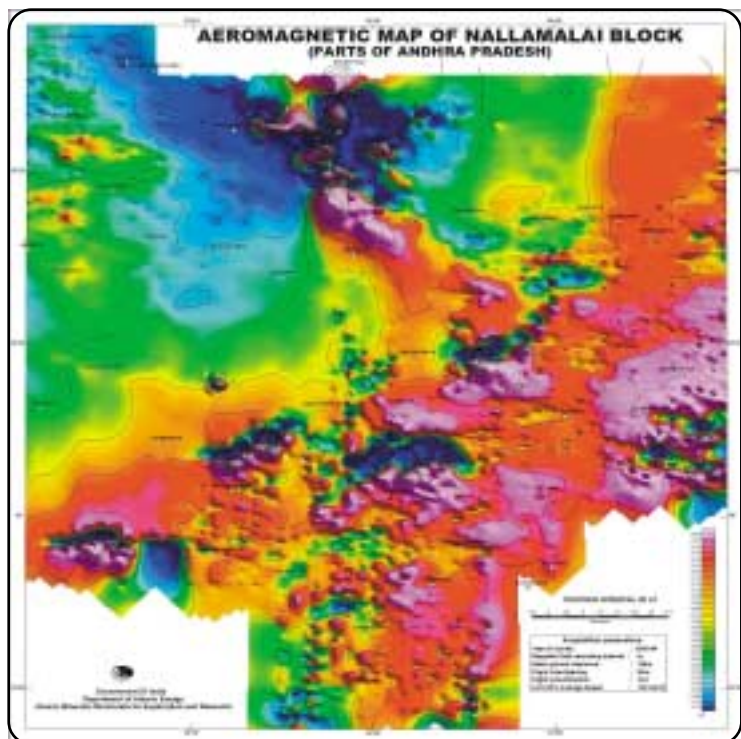
Geophysical exploration techniques are based on the physical property contrast. This group has established a laboratory to measure magnetic susceptibility, resistivity, density and conductivity of rock samples for quantitative interpretation of geophysical data.

Under very fortuitous circumstances, surface geological expressions or clues helped discovery of ore bodies in the past. The present day exploration techniques have become more complex, more difficult and more expensive due to the fast depletion of 'easy finds' of yester years. The current strategy is to explore for the concealed deposits, at depths of 300-400m, in analogy with world occurrences. To achieve this objective, AMD has an ambitious programme of procuring geophysical instruments with state of the art technology for deeper depth of penetration during the X Five year plan. We have already acquired high sensitivity Cesium Magnetometer with Gradiometer and Differential Global Positioning System (DGPS) recently. A Multifunction Transmitter receiver system is in the process of procurement. This system consists of a multifunction high power transmitter (30 KW) and a receiver capable of acquiring multipara geophysical data like controlled source audio frequency magneto telluric (CSAMT), time and frequency domain electromagnetics, time and frequency domain induced polarisation. The transmitting and receiving signals have frequency range of .001 Hz to 10 KHz with various sensors for detection of mineralised targets reliably in the sub surface at greater depth and has capability of providing better models of the target. A digital multipara borehole geophysical logging system, vehicle mounted, is also being procured during this plan period. It will be used to measure, magnetic susceptibility, resistivity, conductivity, induced polarisation and radioactivity in-situ in borehole. These parameters are very useful for correlation, structural evaluations and lithological delineation particularly in an area where non-core drilling is being done. It will also help in optimising drilling operations.



Data processing and interpretation softwares for all the geophysical methods viz. OASIS Montaj and GM SYS for magnetic and gravity, RRSIX 1D and RESIX 2DI for IP and resistivity, EMIX MM plus and EMIX VLF for electromagnetics have helped in better understanding of field data. Interpretation and modeling softwares for TEM, CSAMT and EM data are being procured.

The airborne systems now uses Cesium Magnetometer with 0.001 nT sensitivity and 10 samples per second sampling interval, Automatic Digital Compensation, Differential Global Positioning System (DGPS) with radio link and PC based data acquisition system. The processing of digital aeromagnetic data enable to enhance the weak anomalies and trends which may otherwise be over looked.



Recently, AMD has completed multisensor high resolution heliborne survey in collaboration with NGRI using multifrequency EM system, Cesium magnetometer, Multichannel gamma ray spectrometer, DGPS etc., in Gwalior basin (Madhya Pradesh).

I am sure, with the induction of new generation systems and the existing facility available, my dedicated colleagues will be able to provide support to explore for the concealed uranium deposits at greater depth.

TRIBUTE



Dr. Raja Ramanna, former Chairman, Atomic Energy Commission passed away on 24th September 2004 after a brief illness. Dr. Ramanna was an institution builder, par excellence. He played a colossal role in building DAE as an organisation of high national relevance and international repute. His science policies were directed towards encouraging creativity in basic research, leading to advances in innovative engineering and technology. He stood firmly for indigenisation and self-reliance in nuclear technology. He was the father of 1974 Pokhran peaceful nuclear tests.

Dr. Ramanna was instrumental in directing and guiding the development of the unique carbide fuel for FBTR which has seen, so far a record burn-up of 130,000 MWd/t and is still going strong. The first criticality of FBTR was achieved during his tenure as Chairman, AEC.

With his passing away, the country has lost an eminent nuclear physicist, who was also a great human being.

EFFECT OF TSUNAMI ON BEACH PLACER SAND DEPOSITS

The study of Tsunami (December 26, 2004) generated mineral sand deposition along the coastal tracts in parts of Kerala and Tamil Nadu were investigated by a team of geologists



Layering in Pre-Tsunami Beach Sands at Velanganni Beach and thin Veneer of Post Tsunami Deposition



HM concentration in Kallar Beach, Near Nagapattinam.

from AMD, Thiruvananthapuram during January 17-28, 2005. In Tamil Nadu, 125 km long stretch of the coast between Velanganni in the south to the north of Pondicherry was covered. The studies revealed no perceptible deposition of heavy minerals along the explored tracts. Only a thin veneer of sediment, in patches, was observed in the area. The studies confirmed that the report of '3 to 4 m heavy mineal deposition' due to Tsunami stated in some newspapers was not based on facts. The Tsunami in fact destroyed the pre-existing dunes along the tract and redistributed the sand further inland. Investigations by AMD earlier revealed that the dominant minerals in the heavy mineral suite of the tract comprise pyroxenes and amphiboles (more than 50%) and thus does not have any economic significance.



Beach Placer deposition along road section, Tharayilkadavu, Alappuzha district



Shifting of Heavy Mineral accumulation into the Kayal in the vicinity of Tharayilkadavu, Alappuzha district

In Kerala, in the northern part of Chavara deposit and to its immediate north, Tsunami has brought in the black sand deposits with grades reaching maximum of 96%. Ilmenite dominates the heavy mineral assemblage. Deposition has taken place over a width of 20-30 m with thickness of 0.5 to 0.7 m. The higher concentration of heavies is attributed to the fact that the coast was lined with sea wall and over the years, rich concentration of heavies have accumulated close to the sea wall on the sea side. The Tsunami, due to its high energy has scoured the heavy mineral sand and deposited inland.

From Editor's Desk

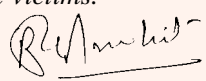
The article by Shri R.K. Nagar gives an insight into the identification of Delhi fold belt as a potential area for augmentation of uranium resources as well as the pioneering work of AMD on Helium investigations in India.

Shri K.L. Tiku in his article has highlighted the role of geophysical techniques in identification of suitable locales for uranium mineralisation. During X Plan, AMD is in the process of augmenting its geophysical capabilities to meet the challenges.

It is heartening to note that for the second time also AMD has been awarded Hindi Rajabhasha Shield of DAE for the year 2003 – 04 since its inception in 2000.

AMD employees have contributed whole-heartedly for the rehabilitation of Tsunami victims in Prime Minister's Relief Fund as well as in the fund created by DAE for the Kalpakkam victims.

Hope this issue will form an interesting reading.


(R.K. PUROHIT)

NATIONAL SCIENCE DAY CELEBRATIONS

National Science Day was celebrated on February 28, 2005 at AMD Headquarters, Hyderabad. The celebrations included an exhibition on "Retrospect and Prospect of Atomic Mineral Resources in India" depicting the exploratory and research activities for atomic minerals by AMD. A special pavilion on 'Prospects of Atomic Mineral Resources in Andhra Pradesh', was set-up to elaborately explain visitors the activities of the organisation in Andhra Pradesh through display of the uranium, beach sand and RMRE exploration areas, uranium mineralisation models and mineral and rock specimen from the State.



Shri A.K. Bagchi, Additional Director (Op-I), AMD inaugurating the Exhibition



To commemorate the occasion, various competitions in painting, elocution, essay writing and model making on basic sciences and atomic energy related topics were conducted to encourage the student community for active participation on the occasion. The exhibition was visited by about 2000 people comprising general public, students from schools and colleges along with their faculty members.



An interactive session was held with the Principals and senior teachers from schools and junior colleges to share views on the importance of the science awareness and various measures to be taken for improving public awareness on the Atomic Energy Programme of the Country.



A video presentation on activities of the Atomic Minerals Directorate for Exploration and Research was well received by one and all.

KALEIDOSCOPE

GOVERNOR OF MEGHALAYA VISITS DOMIASIAT

His Excellency, Shri M.M. Jacob, Governor of Meghalaya along with the Speaker of Meghalaya Assembly visited Domiasiat, West Khasi Hills district, Meghalaya on 08.12.2004.



The Governor and his team was briefed about the proposed uranium mining and location of mill and colony by the officials of AMD and UCIL.

MEGHALAYA DAY CELEBRATIONS

As a part of 33rd Meghalaya Day celebrations held at Central Library,



Photo 2: Honorable Governor of Meghalaya, Shri M.M.Jacob on visit to DAE stall

CHAIRMAN, AEC VISITS CENTRAL REGION

Dr. Anil Kakodkar, Chairman, Atomic Energy Commission (AEC) and Secretary, Department of Atomic Energy visited Central Region, AMD, Nagpur on August 14, 2004. He addressed the scientific gathering and was appraised about the



ongoing works of the Central Region by the Regional Director.

Shillong during January 21-24, 2005, an exhibition was organised by the Department of Industries, Government of Meghalaya. North Eastern Region,



Photo 4: AMD officer explaining the Domiasiat Model.

AMD represented DAE. Hon'ble Governor of Meghalaya, Shri M.M. Jacob inaugurated the exhibition and visited the DAE stall. He was appraised about the various activities of DAE, including the mandate of the DAE followed by the three stages of India's Nuclear Power Programme. The model of

REPUBLIC DAY CELEBRATION AND CULTURAL ACTIVITIES AT HEADQUARTERS, HYDERABAD

Shri R.M. Sinha, Director, AMD addressed the employees on the occasion of Republic Day at Headquarter, Hyderabad and emphasised the need for establishing large and high grade uranium deposits in the country. He praised the efforts put by one and all especially those who are working in remote areas in achieving the goals of AMD.



Republic Day was also celebrated in all the Regional Headquarters and field prospects. On this occasion various cultural programmes were organised, in which employees and their children participated enthusiastically.



Domiasiat Uranium deposit was displayed along with the radioactive sandstone samples and yellow cake. There was an overall positive impact among the masses regarding the nuclear energy programme. DAE stall won Second prize in the exhibition.

Science Congress, 2004 at Cotton College, Guwahati during December 27-29, 2004.

As a part of the Public Awareness programme, an exhibition on "Nuclear Energy - Atomic Minerals Exploration and

NURTURING SCIENTIFIC TEMPER

AMD NER participated in the Exhibition organised for the 12th National Children's



Research: A Perspective" was organised during September 29-30, 2004 at Central Region, Nagpur. Overwhelming response was observed as more than 800 students and 600 general public visited the exhibition.

HONOURS AND AWARDS

- ❖ Dr. R. Dhana Raju, Associate Director (Retd.), was conferred with **Prof. P.R.J. Naidu Gold Medal** at the VII Convention of the Mineralogical Society of India held at Annamalai University, Chidambaram on February 23, 2005.



- A new instrument Jobin Yuon's ICP-OES of JY 2000(2) has been procured and installed in Northern Region, New Delhi.



NEWS IN BRIEF

- Director, AMD inaugurated the AMD Guest House at 106 flats, Shyamlal buildings, Begumpet on January 26, 2005.
- AMD became an Institutional member of the Indian Society of Applied Geochemists (ISAG), Hyderabad in July, 2004.



KITH AND KIN

- 😊 Ms. Gazala Tabussum, Daughter of Shri M.M. Ansari, Driver Grade-I, student of Maharishi Vidya Niketan, Begumpet has secured the **"Best Student Prize"** in the School competition held during the year 2003-2004.



TSUNAMI RELIEF FUND

On December 26, 2004, Indian coast was hit by Tsunami tidal waves causing huge loss of lives and property. AMD shared the grief of the affected population and contributed Rs. 6,08,431/- towards Prime Minister's Relief Fund. The disaster also struck the Kalpakkam coast damaging Government property, loss of precious human lives and personal belongings of the residents of the IGCAR colony. AMD contributed Rs. 65,483/- towards the relief measures taken up by DAE.

राजभाषा समाचार

राजभाषा शील्ड

यह अत्यंत प्रसन्नता की बात है कि परमाणु खनिज निदेशालय को, राजभाषा नीति के प्रभावी कार्यान्वयन तथा हिंदी के प्रचार-प्रसार के क्षेत्र में किए गए उत्कृष्ट कार्य की मान्यता स्वरूप, परमाणु ऊर्जा विभाग की वर्ष 2003-04 की राजभाषा शील्ड प्रदान की गई है। यह उल्लेखनीय है कि विभाग की इस योजना के अंतर्गत पहली राजभाषा शील्ड भी प.ख.नि. को ही वर्ष 2000 में प्राप्त हुई थी। वर्ष 2003-04 हेतु शील्ड 5 नवंबर 2004 को नाभिकीय ईंधन सम्मिश्र, हैदराबाद में आयोजित प.ऊ.वि. के सातवें अखिल भारतीय राजभाषा सम्मेलन के उद्घाटन समारोह में, प.ख.नि. के निदेशक - श्री रमेन्द्र मोहन सिन्हा ने प.ऊ.आयोग के अध्यक्ष एवं प.ऊ.वि. के सचिव डॉ. अनिल काकोडकर के करकमलों से प्राप्त किया।

यह उपलब्धि सभी स्तरों पर - अर्थात् मुख्यालय हैदराबाद से लेकर क्षेत्रीय कार्यालयों तथा फील्ड कैम्पों पर तैनात अधिकारियों एवं कर्मचारियों के सामूहिक प्रयासों के फलस्वरूप प्राप्त हुई है। अतः इस उपलब्धि के लिए पखनि परिवार के सभी सदस्य बधाई के पात्र हैं।



यह सम्मान हमारे ऊपर और अधिक उत्तरदायित्व लाता है - कि हम अनुसंधान लेख सहित अपने लगभग सभी कार्य-क्षेत्रों में हिंदी का प्रयोग बढ़ाने हेतु सार्थक व सतत प्रयास करें।

पूर्वोत्तर क्षेत्र, शिलांग

परमाणु खनिज निदेशालय, पूर्वोत्तर क्षेत्र, शिलांग कार्यालय में दिनांक 13 से 17 सितंबर 2004 तक हिंदी सप्ताह का आयोजन किया गया जिसमें राजभाषा हिंदी से संबंधित विभिन्न कार्यक्रम आयोजित किए गए।



फील्ड कैम्प तिनियांग में भी हिंदी दिवस मनाया गया। दिनांक 11 - 12 अक्टूबर को दो दिवसीय हिंदी कार्यशाला का आयोजन किया गया जिसमें कार्यालय के 10 अधिकारियों / कर्मचारियों को प्रशिक्षित किया गया।

दिनांक 14-15, अक्टूबर को दो दिवसीय हिंदी कंप्यूटर कार्यशाला का आयोजन किया गया जिसमें 10 अधिकारियों / कर्मचारियों को प्रशिक्षित किया गया।

मध्यवर्ती क्षेत्र, नागपुर

यहाँ दिनांक 13 से 17 सितम्बर 2004 तक हिन्दी सप्ताह का आयोजन किया गया। इस अवसर पर कविता पाठ, तत्काल भाषण, अन्ताक्षरी, टिप्पण एवं आलेखन तथा प्रश्नमंच आदि प्रतियोगिताओं का आयोजन किया गया। सप्ताह के समापन समारोह में मुख्य अतिथि श्री. के. जी. भोस्कर, उप महानिदेशक, भारतीय भूवैज्ञानिक सर्वेक्षण, नागपुर द्वारा पखनि, मध्यवर्ती क्षेत्र, नागपुर की हिन्दी पत्रिका अंकुरण-अंक.2 का विमोचन किया गया।



