

its products and services can become cost-effective and reach the global markets only when it learns to upgrade its technologies with indigenous R & D effort specifically designed and executed to suit our domestic conditions. The fact that hardly any country in the world would ever part with their latest and the most cost-effective technology for love or money needs to be driven home hard till it is appreciated and accepted by our Industry.

(c) Our consulting engineering companies must play a dominant role and act as a vital link between the R & D institutions and the Industry by adopting a laboratory or a group of laboratories working in their field of expertise, sponsoring wherever necessary joint development projects, monitoring closely their progress and eventually helping the laboratory in ToT to Industry by carrying out detailed engineering of the scaled-up version of the project and by providing process guarantees to the Industry.

### Conclusions

What I have stated above, I sincerely

hope, looks simple, straightforward and logical. But, will the various linkages get established and the events happen on their own? I am afraid not. For various reasons discussed in this article, our R & D institutions, Industry and the consulting engineering companies have got accustomed to living and working entirely in their own worlds, blissfully ignorant of each other's needs. To get them together, some external pressure is necessary and this can only be in the form of Governmental intervention through appropriate legislation. In a democratic society, legislation alone cannot and will not bring forth the desired results. It should be matched with appropriate 'implementing and monitoring devices' with necessary checks and balances. 'DGTD' which was in existence ever since independence till very recently, could have and should have played this role. Unfortunately it functioned merely as a clearing house for import licenses and foreign collaboration agreements. Their rapport with research institutions, if any, was insignificant. All the same, if the Government is bent upon making our country as Number 1, in some chosen

fields at least by the first decade of the 21st century, it is time now to think about the means of achieving our goals, make adjustments in our policies relating to 'technology development' and 'industrialization' and act firmly and decisively.

May I once again submit that 'self-reliance' at least in strategic sectors is as relevant today as it was in the fifties considering some of the recent global political developments. Trade wars of the future can be fought only with innovative, home-grown, cost-effective technologies and products. In order to achieve this, knowledge-based, timely and effective Governmental intervention in the 'Affairs of the Nation' is absolutely necessary and no responsible Government can leave this task entirely to the so-called market-forces. We have the resources and the capabilities to lead the world in many spheres. What we need is the will to work cohesively with a spirit of understanding keeping the national goals above our individual needs.

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## Armenia: A travelogue

*R. N. Iyengar*

When the Department of Science and Technology (DST), Government of India, asked me whether I would like to go to Armenia to participate in an international conference on earthquakes, my feelings were mixed. DST informed that I may be the first scientist from India to visit Armenia after it came out of the Soviet Union. This of course gave me a feeling of imagined importance but when some of my colleagues wondered where on earth could be Yerevan, I felt quite awkward. Before I went to Yerevan my knowledge of Armenia was limited to what I had seen in Madras, the Armenian street and an outlandish church and of course the Spitak earthquake of 1988 which killed 25,000 people. This earthquake is one of the best documented

and well researched events in earthquake engineering literature. Thus when I left Delhi for Moscow on 28 September, 1993, I was looking forward to a strictly professional experience, but what was in store for me was quite unexpected.

### Air India to Moscow

The flight to Moscow was only name sake Air India. The aircraft did have a few Indian crew; but they served only the first and business class passengers. In the economy class the service was wholly by Russians and this dampened the enthusiasm of many who had expected the quality of service that Air India claims to provide. The Ilyushin aircraft took off beautifully and sailed smoothly all the

way. However, lack of oxygen demo and a casual attitude to safety belt regulations did not quite induce the assurance that makes for an enjoyable, anxiety-free journey at least among the Indian passengers.

At Moscow I was supposed to be received by a person from the Russian Academy of Sciences, but there was no sign of anyone even remotely interested in me other than taxi drivers. The business man from Delhi who exports alcohol to Russia, had already warned me about the uncertainties and lawlessness in Moscow. With only two hundred dollars in my pocket I was in no mood either to hire a taxi or to venture out to a bus in the first snow of the season. After phoning up the Indian Embassy and loitering in the airport for about an hour, I ventured

to speak to someone who looked like one from India, and what a relief it was to discover that he was indeed from India. Kulkarni, a scientist from Delhi, was waiting to receive his colleague, arriving by the same flight, who was also expected to be met by some Russian Academy personnel. After a wait of four hours I hired a taxi paying 40 US dollars and headed for the Academy hotel called Uzkoje. Even as we were about to get into the Mercedes-Benz taxi, an elderly woman with a red cap approached us frantically waving a torn note book on which, I later realized, was written Russian Academy, which for the moment resolved our, more precisely my dilemma. She had indeed come to pick us up and accordingly ordered us out of the taxi. What is more, she gesticulated wildly and cursed the lady from the taxi service, even as I was wondering about my 40 \$. No knowledge of Russian was necessary to understand that she was abusing the other lady with the choicest of words. I got back my money, the importance of which I could not foresee at that time.

### Standing passengers

The next day saw me going to the Vnukovo airport in a vehicle provided by the Academy. I was at the airport by 9.30 am for a flight scheduled to leave at 10.50 am, but which left only four hours behind schedule. As I began to understand how democracy is working in the erstwhile USSR, I shuddered at the thought of spending eight more days in that atmosphere. Vnukovo is a fairly big airport with connections to CIS countries. The lounge where foreigners called In-tourists are checked in, was dingy, dirty and stinking. Neither the escalator nor the toilets were in working condition. It was pathetic to see the faces of the waiting passengers stranded for more than 24 hours at the airport. Not knowing what to do, I started watching the persons around me more closely. There were two Vietnamese youth, perhaps students, who were presenting the passport officer with a pack of cigarettes. Another pair of boys looking very Indian were alternately moving between the first and the ground floor studiously avoiding to look at me. Finally, unable to contain my curiosity I went near one of them, drawing him into a conversation. I was amazed at the courage that these brothers from Bareilly

had. The elder Gupta was already a student of engineering in Ukraine, while the younger Gupta aspiring to become a doctor had arrived in Moscow with a few thousand dollars. His brother who spoke Russian fluently was negotiating with the agents to secure a seat for his brother. Yes, there are agents, both Indian and Russian, who for a fee could secure medical seats. It turned out that it was much cheaper to buy a seat in a professional institution in Russia than in Karnataka. The whole course can be completed with about 5-6 thousand dollars in Moscow whereas the capitation fee itself would be three times as much in Bangalore colleges. The younger Gupta had arrived in Moscow only two days ago and was staying at the airport under the care of his brother till he could settle down with a medical seat. No wonder, I aroused in him memories of his parents and after pouring out continuously for over half-an-hour, he asked whether I could drop a letter for him in any post box once I got back to India. Even as Gupta started dozing off with the knowledge that his letter will be in the hands of his mother within two weeks time, I started wondering whether my trip was worth making. Meanwhile the Yerevan flight was announced and I was at the passport control. The visa issued at Delhi by the Russian Embassy was a piece of paper folded in three, as in the days of the communist regime. A part had been taken away already at the port of entry. As the Passport Officer took away the remaining two-thirds, my heart missed a beat, thinking already of my return trip. As I pleaded with the officer to hand me back the piece of paper, he tried to convince me in his broken English, that these were not the good old days; Russia and Armenia were now two independent countries. It was too late when I learnt that a ten-dollar note could have changed the political perceptions of the Officer considerably. The hand baggage was X-rayed disinterestedly by two women officials and I found myself face to face with the other few passengers bound for Armenia in the small lounge.

An elderly bearded man accompanied by a youth accosted me and was eager to start a conversation. I mistook him for a Christian missionary but he corrected me and said that he was working for an American church group which works with

like-minded Russian groups. He asked quite a few questions about India, particularly about the Christian community and whether they were discriminated against in day-to-day life. He was quite surprised to know that Christianity had set foot in Kerala in the first century A.D. itself. He and his companion were going to Armenia to renew their contacts with the 1988 earthquake victims. Hesitatingly he asked me whether I was a businessman. I told him who I was, but he still wondered, of all the places on good earth why I was going to Armenia. To my shock he asked me whether I knew that there was only one hotel in Yerevan where hot water and electricity may not be available. This fact was not known to me, but it was too late to be worried about it. An elderly woman escorted us to a small aircraft on which was written in bold letters Armenian Airways. The situation near the aircraft ladder was breathtaking. There were nearly a hundred persons jostling to board the aircraft. As I wondered what I should do, the bearded American alerted me that we should somehow get in and occupy any vacant seats. That is precisely what I did! It took an hour for the aircraft to take off, even as passengers were pushing and pulling to get in. Oh! what a sight it was! Children crying, sick people coughing endlessly, youngsters shouting and almost fighting with the crew members! There were many standing near the aircraft still weeping when the ladder was removed. As I started surveying what was happening inside the aircraft, I was astonished to find two passengers standing, who later sat on the floor. The aircraft notwithstanding all the abuses to which it was being put, flew beautifully. Apparently, the Soviet built planes are structurally and aerodynamically excellent. The three hour flight was quite comfortable. The passengers were served with a cup of coloured water called Uda. But for this, the scene inside was reminiscent of a second class train journey in an unreserved compartment between Delhi and Lucknow. The scenery below was pleasant. The lush green plains were left behind yielding place to rugged mountains, which meant that we were nearing the collision zone between the Asian and the European plates. Now, the Armenian territory was clearly visible and as we approached Yerevan I was struck by the lack of cultivation. The land looked more

brown than green. The defunct nuclear power plant standing as a stark monument was visible. The big question after landing in Yerevan was, who would be there to receive me? No one turned up, nor were there any messages even at the office. I was losing my calm since the phones at the airport did not work and I did not know the name of the hotel at which I was booked. The several faxes sent and received, the assurances of the conference organizers, the information to the Indian Embassy at Kiev were all completely wasted. However, when the Armenian host of the bearded American found out my problem he offered to help. His solution was simple. He would take me to the city and check up at Hotel Armenia, the only hotel in the town. In case I had no booking I should stay with him, i.e. with M. Karapetian, as his guest! Elated by the courtesy shown by an unknown Armenian, I heaved a sigh of relief. I finally found the conference organizers at Hotel Armenia. Seeing me they looked at each other, whispered some words and apologized for not showing up at the airport. NSSP (National Survey for Seismic Protection), an Armenian Government agency specializing in earthquakes was the organizer of the conference. Just then the news about the killer earthquake in Maharashtra had been received. An ISD link was available from the hotel and the best I could do to assuage my feeling was to talk to my wife in Bangalore about the disaster. I felt miserable and wished I was back home doing something useful to alleviate the misery of the earthquake victims.

### Madras connection

Next morning H. Seferian, who had sponsored my stay in Armenia met me to take me in his chauffeur-driven car to his office. A short man, with a short but smooth beard and emotive eyes, Seferian expressed sorrow about the earthquake in India, but felt that no outside help may be necessary since India, according to him, had everything needed for life in the modern world. Seferian headed a business corporation called Yan's Foundation International, which has offices in Brazil, Paris and New Delhi. I learnt that Seferian was born in Brazil but had now settled in India with his family for the last eleven years. He felt deeply for the bad situation in Armenia, his home country. One of

his ambitions was to bring India and Armenia close together again, as they had been through the ages. In the last century there were more than one lakh Armenians involved in trade with India. The settlements in Surat, Bombay and Calcutta have totally vanished, but a church and a cemetery still remained in Madras. Madras has very special significance to Armenians. The first Armenian newspaper was printed in Madras two hundred years ago and the priest who published the paper is buried in there. Armenians are eager to celebrate in Madras the bicentenary of their newspaper, thereby showing their indebtedness to India for nurturing and protecting their culture. Seferian spoke eloquently about the strength and weaknesses of India *vis-à-vis* the erstwhile communist countries and Brazil. According to him, just about a hundred *Sardarjis* could transform Armenia into an agricultural wonder. Indian help to Armenia in food production would definitely bring the two countries together. Armenia is a land-locked country, blockaded on two sides by Turkey and Azerbaijan. The land route with Iran is not very active while the other CIS countries like Georgia and Ukraine have their own problems. Armenia is 100 per cent literate and its people are proud of their ancestry, religion and culture. They believe that two out of the four tribes forming their country have come from India. They feel threatened not only by earthquakes but also by the countries surrounding them. Psychologically they are drawn nearer to pluralistic societies like India and USA, where ethnic minorities have been traditionally protected. Before Armenia became the first nation in the world to accept Christianity as its official religion in 301 AD, it was largely Zoroastrian. The fact that Zoroastrians are flourishing in India even today strikes a friendly note and a few would even exclaim 'how nice of the Hindus'. In the short time I was in the office of Seferian, a variety of people came to meet him. An actress who is also a historian, sought financial support for producing TV serials projecting the history of Armenia. There were others seeking jobs, and still others discussing a five star hotel project in Yerevan. Seferian explained how Armenia was sitting in an economic pit unable to rise. With no oil, coal and gas, Armenia depended on its five hydro-stations for power. The only nuclear plant had been

closed down due to emotional reasons following Chernobyl and the Spitak earthquake. Half of its 3.5 million inhabitants live in Yerevan. The remaining half are distributed over the other three cities and a few villages. With less than the population of Bangalore city for a whole country, many in India would perhaps think that it should feel wonderful. But unfortunately with petrol costing Rs 60 a litre, the factories closed and war threatening the borders, the country was just managing. The only export appeared to be its famous cognac and mineral water; a few tourists and the large number of American Armenians being its other economic support. Seferian drove me to the ministry of external affairs to sort out the visa problem on my return trip. The secretary received me kindly and first expressed the sympathies of his government for the earthquake victims of the previous day's disaster in India. Next, he explained how Armenia had geared up for seismic disasters and how within an hour relief planes can fly to India if necessary. I was perplexed to learn that Government of India had appealed to the International community for help for a 6.2 magnitude shock. Anyway my immediate anxiety was to secure a proper entry visa to Moscow on 7th October. The secretary assured me that he would take care of things and I need not go to the Russian embassy for the visa. The idea was to issue me an exit visa from Yerevan on 7th which would be valid for two nights stay in Moscow in accordance with a treaty signed by the CIS countries.

### The Conference

The Conference officially opened in the afternoon with all fanfare and publicity. A two-minute silence was observed to show respect to the Armenian and the recent Indian earthquake victims. At least six radio, TV and press correspondents interviewed and questioned me about Indo-Armenian relations. It was clear that more Armenians knew about India than the other way round. In the evening we were all taken to a lake resort called Blue Sevan which was the venue for further proceedings. The two-hour drive was very pleasant, but not the lakeview lodge where we were housed. In its heyday the place was the holiday resort for the Soviet Generals and other VIPs

of USSR. However, now with no arrangements for heating and temperatures hovering around 1°C in the night and barely above 10°C in day time, our stay was anything but comfortable. The physical discomfort was compensated at least in my case by the warmth and interest shown towards India by almost every Armenian present. A lady scientist by name Tamara introduced herself and instead of discussing about earthquakes mentioned her interest in *Bhagavadgita* and Krishna. She confessed that Gita had enriched her life and was in no conflict with her own orthodox Christianity. She had read several books on Hinduism in Armenian translations. Then there was a famous oceanographer who had visited India at least six times. He and his wife were fond of Indian dress and food. He declared that it was only in India with a rich variety of fruits, vegetables, and lentils that one could lead a healthy vegetarian life.

On the first evening a film was shown on the Spitak earthquake of 1988 and its after effects. By mistake or by design this was preceded by a clipping of the 1915 genocide of the Armenian people by the Turks. The technical presentations at the conference were very interesting. The Americans and the CIS representatives were in majority but there were two Chinese, two Iranians, one Japanese, one German and three French scientists also. It was interesting to learn that the Iranians had flown directly from Teheran while the Chinese and myself had arrived via Moscow. All others had come into Yerevan from Paris. The two striking features of the meeting were the lack of good projection facilities and the large number of local women participants. The Conference was successful considering the fact that Armenia was able to bring together scientists of several nationalities into the country notwithstanding the blockade it was facing. The highlight of the meeting (according to me) was the cultural programme. There were a bewildering variety of colourful dances supported by a group of musicians. Two solo music performances were fascinating. The first one was a drum played by a boy of about twelve years. The drum was hung over the shoulders and the instrument looked like the big ones seen in Gujarat. The sound was almost like that of the mridangam. The beats and the cycles seemed very similar to our

own *Adūtāla*. I marvelled at the ease with which the boy played the drum. Next came on the stage two persons holding pipes. First the drone (*sruti*) started. Next the Oboe which looks like a flute but which is played using reeds like a *Nāgaswaram* started. The sound produced was not too shrill like a flute nor too loud like a *Nāgaswaram*. There was no drum to accompany these. The sounds produced gradually seemed to fall into a pattern which was after all known to me. Yes, indeed it was *Rāga Abhogi*! Quite impressed at my discovery I intently followed the music which did not have any special rhythmic structure. It did have some punctuations and I was suddenly startled to recognize that it was like a *mantra* from *Sāmaveda* with even the *haauhaau* intonations intact! After more than a month the memory of this oboe performance still haunts me.

On the immediate Sunday we went on a field trip to Leninakan (presently Guimri) and Kirovakan to see the rehabilitation programme for earthquake victims. Even after five years telling scars of the damage were still visible in these places. Large number of apartment blocks had been built with World Bank aid. It was gratifying to note that buildings not occupied by the public were used by the Government of Armenia, for full scale dynamic testing using exciters to demonstrate that they would withstand severe shaking during future earthquakes.

### NSSP

Sixth October was the last day when we were again in Yerevan to visit the NSSP. This is the nodal agency responsible for providing seismic preparedness and protection to the country. It is a very impressive organization where under one roof, a variety of programmes such as monitoring of seismic precursors, strong motion instrumentation, aseismic design, construction and retrofitting of buildings, disaster relief, including a dog squad, are handled. A standing committee has been constituted to issue warning to the country about an impending earthquake, if the experts are unanimously convinced about the predictive potential of the various precursors. So far there have been no predictions, but the concept itself is an indication of considerable alertness on the part of NSSP headed by the famous seismologist Balassanian.

### Indian students

Seventh October was the day of departure. I and the two Chinese were taken to the airport by 9 a.m. to catch a Moscow-bound flight supposed to leave at 11 a.m. All others had happily left for Paris already. Going out of Armenia turned out to be more difficult than coming in. Every hour the authorities would postpone the flight by an hour, which meant that there was no way we could go into the town for lunch. This dragged on for so long that the NSSP colleagues excused themselves and went home! Left to my own devices, I was quite elated to find a group of Indian students studying medicine in Yerevan. There were two girls and four boys occupying a corner in the lounge. They were equally pleased to see me and we compared notes. They confessed that their life was difficult, particularly after the dissolution of the Soviet Union. The increasing confusion in the CIS countries has been detrimental to academic pursuits and it is no more advisable for students from India to buy seats in Russia or in other places. Of the two girls at the airport, Anup was returning to Delhi since she had secured admission in Ajmer. Even though she had spent one year in Yerevan her friends were unanimous that there could be nothing comparable to studying at home. She had been waiting at the airport for a flight to Tashkent, for 24 hours. Her friends were providing her moral support and trying to secure her a seat in a cargo flight to Ashkabad, in case the Tashkent flight did not take off. The other girl was Sowmya from Madras. She had only one more year to complete her medical course. Her friends told me that Sowmya felt extremely home sick and was eager to talk to me if possible in Tamil. Of course, yes! Tamil is my mother tongue. We talked for nearly an hour about her parents, her brother in USA, the Cauvery dispute, the living and teaching standards in Armenia. These students were happy to meet a teacher from India. I was served with Blintchkies (similar to Aloo Paratha) and Coke. An American seismologist watching all this was quite impressed and expressed appreciation for the extended Indian family feeling.

The flight to Moscow was at last called at 7.30 pm. Again we were escorted by a middle aged woman, who literally went on asking near each aircraft, whether that

was the machine meant for Moscow! Finally after locating the aircraft, we were told to wait on the ground until called again. We sat in a nearby lounge for another four hours before boarding. The aircraft was quite full but still we found seats conveniently as the aircraft was rather big and there was space for everyone. As the aircraft took off smoothly, the Captain's voice in broken English came along to inform that the vehicle had fuel sufficient only for one hour. That would mean a landing at Sochi inside the Russian border for hardcash refueling. Anyway I had by then lost the sense of time till the Chinese colleague made a pertinent remark. Since there was no X-ray and frisking at Yerevan how could we be sure that we were not going to be hijacked? Well, luckily, nothing happened till we landed again at Vnukovo Airport, Moscow, very early in the morning. By now, I had picked up the company of Vijay, a student from Bidar, who was changing his college from Yerevan to St. Petersburg. With a night curfew in Moscow I had to wait till day break, when with Vijay's help I could meet Kulkarni again. I reached hotel Uzkoye only to find that the Russian Academy had changed its mind a day earlier and had shifted me to their other hotel on October Square!

### **Institute of Earthquake Prediction**

As soon as I reached hotel Akademiskaya

spending my own money, I was asked to be ready by 11 O'clock to go to IIEP (Intl. Inst. for Earthquake Prediction). The most important thing for me was however, to have a hot shower, which luxury I had missed for the last six days. Thus I reached IIEP, rather late nearly at lunch time. To my pleasant surprise, I was served a very tasty vegetarian lunch. The Institute is a well known research lab for earthquake studies. I was exposed to their interesting approach for predicting possible future locations of earthquakes. It appears that many past epicentres in India as well as in other parts of the world lie on knots which are the intersections of at least three lineaments or faults. This does not mean that every knot produces an earthquake. A rigorous pattern recognition methodology is needed to pin point potential epicentres. A huge map of India with the knots and past epicentres including Khilari, was shown to make the point that their theory of knots has to be taken seriously. The rate of success in predicting the locations through their theory is very high even for California.

### **Ninety dollars to freedom**

Finally it was 9 October, the day of departure. In a joyous mood I called Air India only to be told that the flight would be leaving at 13.45 and not at 14.45 as indicated on my ticket. Fortunately, the Academy had provided a vehicle so that I reached the airport on time. But, then

my difficulties had not yet ended. At the passport control I was told that my exit visa issued by the Armenian Govt. was invalid beyond one night. I was curtly taken out of the line and was told by a police officer that I had committed an offence by overstaying. He took me to the Air India Personnel at the check-in counter and declared that unless 150 US dollars were paid I could not leave Moscow. Even before I could talk, he ordered my checked-in baggage to be removed. The Air India man intervened and explained to me in Hindi that I better pay and buy my freedom. In case I had no money I could contact the Embassy, but the process would be quite messy. I did have the money, but not completely in cash. About this the officer had to consult his superiors and vanished. Finally I was asked to pay only 90 dollars for which a receipt was given. The flight back home was pleasant. Two businessmen and two space scientists also returning to India were my immediate copassengers. We had a lively discussion about our experiences. It appeared to everyone that the superpower status of any country is first and foremost psychological. Other matters are accordingly arranged. Someone remarked that the weakness of India was not to have yet realized that it was in fact quite strong.

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