

Biological Citizens: Risk and Radiation in Southwest India¹

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Introduction

The thorium/monazite belt of southwestern India is, in most respects, a marginal place. Yet, since the beginning of the 20th century, this 100km long strip of beach sand has been deeply embedded in global circuits of capital and power. First because monazite had important industrial applications, and later because thorium was identified as a nuclear fuel, this region has had direct experience of the boom and bust of global business cycles and has suffered and gained because of the strategic value of the thorium that is so plentiful here (Abraham 2011). These are not necessarily contradictory or unusual circumstances from a development perspective: what has happened to this region as a result of external forces is probably more common than most realize, and may even be typical of the condition of postcolonial “enclave economies” (Gunder Frank 1966). What makes this region distinct, however, is another kind of external force, namely, the unusually high background radiation that comes from the same soil that has made it economically and symbolically important. Radiation has transformed this fishing community into a biomedically-defined collective, leading this population to suffer the scrutiny of both state and oppositional civil society groups. But the environmental threat of radiation alone does not summarize, adequately, the condition of living that characterizes the lives of people in this region. Coastal erosion that undermines the ground on which lives are built, the devastating effects of the December 2004 tsunami, the dislocations brought about by post-tsunami rehabilitation, the loss of livelihood as fishing declines as a profession, the threat of loss of land by the sovereign imposition of eminent domain: all these add to the complexity of the environmental threat. An everyday sense of dread -- “even more dangerous than tsunami” -- emerges when people reflect upon a present marked by untimely death and unwilling displacement. What follows is an ongoing meditation on a subject that following Joseph Masco, we might call the global ‘nuclear borderlands’ (see also Kuletz 1998). It also draws on Ulrich Beck’s conception of the risk society (1992), Nikolas Rose (2007) and Adriana Petryna (2002) on biological citizens, and emerges from a historically and ethnographically-grounded view of an apparently “out-of-the-way” place in contemporary India (Tsing 1993).²

¹ Earlier versions of this paper were delivered at the ‘STS in South Asia’ conference, Austin, TX, May 14-15, 2010, and the 4S conference, Tokyo, August 25-29, 2010. Many thanks, particularly to Kath Weston, and to the conference participants for their useful comments and suggestions. Fieldwork was supported by the National Science Foundation (US). My grateful thanks also to M. V. Ramana who kindly shared with me his collection of articles on radiation and public health in the thorium belt.

² The following section is based on field work conducted in two sites, one in Tamil Nadu, the other in Kerala, from January to June 2009. There are marked differences between the two states, even though the distance between the two field sites is only about 100km. Although both areas identify as fishing communities, the people living in Tamil Nadu to the south tend to be Catholic Mukkuvars, and in Kerala, to the north, Hindu Aryas (Dalits). The Catholic influence is very visible in TN. Tamil villages tend to have very large churches dominating the main open area of the village and village priests, often young and highly motivated, play an important social role. Kerala coastal villages are less concentrated around a central point and are more spatially diffuse. Their boundaries tend to be defined by natural features such as small backwater lagoons and man-made boundaries such as sea walls and bridges. The state’s presence is far more visible in Kerala, with a buzz of activity centering around the local panchayat office, where local elected officials, ward members,

When Place Vanishes

When Krishnamma, 51, came to this area, thirty years ago to marry a fisherman, she was immediately struck by the color of the sand; it was so different from the “white and clean” sands of the village she grew up in. It felt like “mud and dirt,” she recalls, but she got used to it. Balachandran, a 50 year old ward member from Alapad, remembers the local topography divided into three distinct areas during his childhood: there were large sand dunes and black sand deposits, there was a grassy zone that was ideal for playing football, and there were backwater ponds and lotus pools. Large areas were devoted to cultivating paddy. The sea was over a kilometer away and it was possible to walk long distances along the seashore. Now, he says, things have changed: the paddy has gone, the sea wall has changed the nature of fishing, and the dunes have disappeared. Kairali, who also moved to this area after marriage about 35 years ago, remembers a vast sea shore with small palm trees where the men would sit and talk and women would relax. She recalls a six -room toilet built by the IRE that was used extensively by the villagers as none of them had their own toilets. Now, she says, “it is gone without a trace. Sometimes the pillars appear when the sea recedes” but she cannot really be sure where it is anymore.

Coastal erosion has been taking place along this coastline for generations. Even before the devastation of the December 2004 tsunami, which submerged large portions of the seashore, there were regular floods that took habitable land away. Nature’s work has been supplemented by human (and mechanical) effort. It used to be the case, some asserted, that large sand dunes prevented major erosion. Now, due to sand mining, those dunes have disappeared and the effects of erosion are much more serious. Preetha, who moved to Alapad from Arattupuzha, is sure that the “sea wash” mining procedure of the IRE plant has disturbed the natural order of the coastline. Parthan, a 73 year old resident, describes the steady erosion in terms of the “joining of the sea and the backwaters” -- a disturbing mixing of salt and fresh water -- a phenomenon that only used to happen temporarily, during periods of high flooding. This is, he said, because of indiscriminate mining by the IRE.

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Extracting Value

Thorium sands are mined in a process that hasn’t changed that much since the beginning of the century. The first step involves people carrying head-loads of beach sand to a mechanical separating table. The first separating machines probably involved a so-called wind table that channeled wind in order to separate heavier from lighter particles, not that different from the process that is still used to separate impurities from rice grains. Wind tables were followed by mechanical, and then electro-magnetic, density separators. I saw a massive dredger with spiral concentrators sitting on a floating pontoon -- a powerful looking machine that seemed ready made to take part in the next *Transformers* movie -- in the process of being disassembled and moved to its next location. Although I had hoped to photograph

and administrative staff can be found. Both churches and panchayat offices are places where (private and public) funds are disbursed and where certain forms of social mediation and adjudication take place. I was assisted in Tamil Nadu by Venis, a local resident and well known singer/song writer. In Kerala, I had the invaluable assistance of Anitha Sharma, a well known ecologist and children’s educator.

it, I was dissuaded from doing so by a uniformed security guard who made it clear that the machine's image was protected by national security.

The power of Indian Rare Earths to control its images, and, more important, the ground it worked, was a constant refrain. The IRE is legally able to take over even inhabited land through the exercise of eminent domain. This produces a complex of reactions among local residents, ranging from anger to resignation to hope. As a large employer, the only local representative of the national government, little can stand in the way of IRE.

That said, employment with IRE is highly valued. In Chinnavillai, near Nagercoil, the local panchayat adopts its own form of protection, by denying or delaying the registration of new families. Without registration or proof of residence, families lose access to a variety of state entitlements. These actions are justified by asserting that well-paying IRE jobs are relatively few and highly prized; hence, they "belong" to the local long-term residents. Land acquisition efforts have not gone without protest. A number of "strikes" had taken place in Kerala and roads had been blocked to prevent the movement of IRE trucks. IRE's deep pockets soon bought off the leaders, and the movements usually fizzled, though not without leaving deep resentment against the company and its high-handed ways.

A number of families have sold land to the IRE and moved away, breaking the always-fragile ties of local community. Balachandran, the ward member, expressed the view of many when he criticized the compensation paid by the IRE for people's houses and land: "For each square foot of habitation, at least Rs. 900 should be given. But [IRE's compensation rate is] only Rs. 400." Preetha agreed that no one could possibly purchase another piece of land with the meager compensation given by the IRE. That didn't stop people selling to them, however. Parthan would not have minded as much if IRE was more like the state mining company, Kerala Mining and Minerals, which he felt behaved in a more ethical way. He felt that IRE should pay for the land, provide at least 5 cents (about 2000 sq. feet) of new land elsewhere, and offer employment to one member of the family. Others complained that well-paying IRE jobs had become part of political patronage and were thus beyond the reach of local people. Kairali saw the promise of a land purchase by IRE as her (only) chance to move inland, away from the dangerous sea and beach.

The movement of people away from this area in the last few decades came up repeatedly. Respondents shuttled between describing displacements caused by IRE and resettlement efforts following the tsunami. Resettlement rarely improved living conditions. Since resettlement areas were often far away from the boat jetties and fishing beaches where they worked, "men had to travel long distances ... They have to get up early to reach these shores and travel back late. So the vigor [for life] and energy for work is dull." Krishnamma was explicit about the social cost of these movements: "As a society we have lost many things ... people who lived close by have gone far away. If there is a celebration or death how do we inform our friends and relatives? How do we reach them?" Community cohesion had declined in other ways as well. In one notorious instance, children had taken their widowed mother's tsunami compensation leaving her destitute.

With so many departures, some parts of the beach had become deserted making women nervous about going out alone and in the evenings. Public drinking had become much more common, and some young men had taken to brewing illicit liquor in newly forested casuarina plantations. Balachandran summed up the current state of the social habitus in an evocative comment: "Fishing as an occupation is not possible when the society itself is feeling insecure and isolated."

Fishing communities have always lived with fear and danger, but the uncertainties of the present are altogether different. "Fishing by itself is a dangerous and frightening job. But we travel in the boat taking blessings from the Mother Goddess," Parthan said. "The tsunami was an experience that was new and unheard of ... the sea cannot be stopped by laying stones." The comfort provided by the blessings of the Goddess appears incommensurable with the modern sense of security offered by the stony buttress of a sea wall. Prameela captured this excess of insecurity when she said, "this fear which is an everyday feeling is more dangerous than tsunami".

Location

The picturesque beach that runs from Kanyakumari to Kollam (Quilon) contains one of the largest concentrations of monazite in the world. Monazite is a phosphate compound that contains significant quantities of rare earths.³ Also present is the radioactive element thorium. Thorium (Th-232) is fertile – a potential nuclear fuel -- as it can be converted to fissile uranium (U-233) following absorption of slow neutrons. This physical condition is the basis for India's Department of Atomic Energy's (DAE) long-term strategy for becoming self-sufficient in the production of nuclear power, defined as a project of great strategic and national importance (Sarabhai 1970). Around 100,000 people live in close proximity to the monazite sands. The level of naturally occurring background radiation here is roughly 7.5 times higher than in areas lying to the interior of this region, at once raising the question of potential health risks (Ahuja 1973). Not surprisingly, given the strategic importance of the monazite sands for the Indian nuclear power program, agencies of the Indian state have long monitored the health effects of background radiation.

Experiment

Consider the field notes of John Bugher, Division of Biology and Medicine, US Atomic Energy Commission, written in January, 1957. "From Cape Comorin [now, Kanya Kumari], we followed the highway to Nagercoil and at this point diverged on a side road which goes to the coast at [Manavalakuruchi]. This is the first spot at which the Government is engaged in the recovery of black sands from which thorium is extracted. From here northward for a hundred miles, these radioactive sands are to be found widely present in the beach sands and extending back in some cases as much as half a mile, although for the most part the general width is much narrower than this, ordinarily about 200 yards comprising the generally observable width of the black sands deposits. It was obvious that these deposits are not uniform but due to wave action the more dense material has been concentrated in

³ For a monazite-centered history of this region, see Abraham (2011).

broad patches ... where it is simply shoveled up, carried in head baskets to small narrow gauge rail cars which transport it to the concentrating plant. We were told that 120 head loads makes four tons and one man ordinarily will carry five tons during the day for which he receives (two and a half) rupees. We estimated about 100 laborers working on the carrying of sand from the dunes to the point of pickup by the narrow gauge railroad so that one would estimate about 500 tons a day from this one small operation. It will run about 0.2% thorium in the form of monazite. Other minerals, particularly rare earths occur, and these have been in times past the chief interest. [...]

With regard to the character of the fishing people, it is generally true that the villages are very numerous and in some places almost continuous along the beach so that the villages for the most part are actually built on the beach sands, some of them quite black. The people live intimately with the beach, since they sleep on mats on the sands within thatched huts. Those concerned with the repairing of nets sit and lie on the sands and many of the areas so used are quite black and must exhibit considerable activity. [...]

With respect to general health, these people subsist on a diet largely fish, coconuts, and rice. Rice is expensive. Consequently they do not utilize it the extent they would like. There is no protein deficiency and one should say also no deficiency of fat. The people as a whole, judging at least by the ones who clustered around us on every occasion, look well fed and well nourished. The obvious evidence of genetic disturbances were rare save for an albino, the first I have seen in India, at least to notice the individual. This body, showing the usual skin reactions to the sun and marked photophobia, stood out rather prominently in the crowd of brown skinned youngsters.”⁴

The key phrase in this account is put delicately: “the sands... are quite black and must exhibit considerable activity.” By “activity,” Bugher means radio-activity. Around the time of Bugher’s visit, the World Health Organization’s expert committee on the effects of radiation on humans released a report that identified the black sands of Travancore as one of the world’s highest naturally occurring radiation belts, and singled it out for the presence of Bugher’s “fishing people” who had long been living here.⁵ In other words, here was a natural laboratory for studying the effects of prolonged exposure to radiation. Little wonder that Bugher, in particular, would look for visible signs of “genetic disturbance.”⁶

The idea of the natural laboratory in relation to the nuclear field reached its apogee with the Atomic Bomb Casualty Commission (ABCC), a field study led by the US Atomic Energy Commission to record the long-term effects of radiation on human subjects. The subjects were selected survivors of the Nagasaki and Hiroshima bomb explosions and the ABCC was set up under the condition that survivors would be monitored and looked after but not treated (Lindee 1994). Medical intervention would have upset the study controls by blocking

⁴ “Dedication of Indian Research Reactor,” Report of John Bugher. Special Assistant to the Secretary for Energy and Outer Space. Records relating to Atomic Energy matters, 1944-1963. RG 59. Country files. Box 416. U.S. National Archives and Records Administration (hereafter, NARA). Italics added.

⁵ *Effect of Radiation on Human Heredity. First Report of the Expert Committee on Radiation.* Technical Report no. 166, WHO, Geneva (1959).

⁶ Bugher was involved with Project Sunshine, the so-called “body-snatching” project of the U.S. AEC. See Eduardo Gonçalves, “Grave Injustice: Body Snatching in the 1950s to aid nuclear research,” *The Ecologist*, May 2001.

the “natural” playing out of the effects of intense exposure to radiation following the two atomic blasts. The ethical implications of such an experiment were all too apparent to many at the time, especially including the Japanese, but living under Occupation rules made it near-impossible to protest this inhumane decision allegedly taken in the name of “science.” A few years later, knowledge of Nazi experiments with concentration camp prisoners during World War II became widely known. The outrage at these crimes against humanity and ensuing soul searching among scientists and philosophers should have made it even more difficult to imagine that this raw experimental gaze could again be applied to human populations. But the nuclear field is, apparently, not subject to the same rules as the rest of the scientific world. As late as the 1990s, Indian Atomic Energy Commission scientist A. C. Paul would write, “The exposure to natural radiation of such a high magnitude to a large population of this size is unique. This provides a rare opportunity and challenge in the area of environmental dosimetry and radiation related epidemiological studies.”⁷ The “rare opportunity and challenge” faced by Paul and his colleagues was not the care and welfare of the population facing a severe environmental threat. It was, rather, the possibility of collecting data that was etiologically unique and scientifically valuable. The problem of care was, if at all considered, someone else’s.

“Background” radiation has been here foregrounded, producing a field occupied only by science and scientists. The living human residents have been reduced to passive objects of study and have receded to the background of the experimental stage. They have no identity or history beyond their immediate condition of long term exposure to natural radiation. Here is a situation that crudely and directly invokes a sovereign field of power, where the right of life and death is in the hands of elites who are beyond public accountability and who hold in their hands the ultimate power of life and death. As Foucault puts it, “[i]t is thanks to the sovereign that the subject has the right to be alive, or possibly the right to be dead.” (240) This is an example of what Ashis Nandy and his colleagues (1988) have called the vivisectionist perspective, which they define as a characteristic of modern science more generally. It is, however, not the only view that prevails in the thorium belt.

Responsibility

A second approach to understanding the condition of long-term residents of the monazite sands derives from a public health perspective. The concern here is to understand if and how residents are affected by exposure to background radiation, and, if so, what might be the medical evidence and actuarial significance of such biological injury? In practice, and indicating the presence of a not unresponsive state with, nevertheless, strong institutional interests, the studiously neutral and uncaring orientation of the experiment transforms into a search for etiologies of possible injury and disease as defined by the protocols of public health discourse. Public health is, when compared to the experimental mode, a less closed regime of knowledge and as a result the fault lines of this discourse also become visible.

The Indian Department of Atomic Energy (DAE) has sponsored the majority of studies of the health effects of human exposure to background radiation. No DAE-funded study finds any

⁷A.C.Paul. et. al., “Natural Background Radiation Exposure in the Western Coastal Villages of Tamil Nadu, India—A Preliminary Study,” *Proc. Of the 24th Conference of the Indian Association for Radiation Protection*, mimeo, p. 278

connection between long-term residence in the high radiation belt and the incidence of negative health effects that are statistically significant. Typical studies report the results of large-scale surveys examining various aspects of environment-human relations, seeking, for instance, to establish the extent of human exposure to airborne thorium, or to measure the quantity of radiation exposure within homes.⁸ A subset of studies directly examines the health impacts (the onset of cancers and other high risk factors for morbidity) of proximity to high natural background radiation.⁹ In other words, they are concerned with radiation-induced morbidity during the life-course of the individual. For instance, a study conducted jointly by the Regional Cancer Centre, Trivandrum, and the Bhabha Atomic Research Centre (BARC), a unit of the DAE, published in 1999, concluded that “there is no evidence that cancer occurrence is consistently higher because of the levels of external gamma-radiation exposure in the area.”¹⁰ These results have been widely touted by the DAE top brass, allowing them to make a public case that there is no breakdown of the state’s responsibility to its citizens. What are being excluded from these studies, of course, are the possible genetic effects, which are unlikely to show up in the same generation, or directly affect morbidity if the offspring survive birth.

A study published by BARC’s Monazite Survey Project, which looked a little deeper into the matter, “did not show any significant difference in the frequency of dicentric, translocations, inversions or other types of [chromosomal] aberrations known to be associated with radiation exposure.” However, the study went on to note “[a] striking observation was the presence of rogue cells, the rarely occurring metaphases with a high level of chromosomal damage, which have not been reported previously among newborns.”

¹¹ Other than this finding, a small part of a longer paper on chromosomal aberrations in newborns, I have yet to find a study supported by the DAE that shows that the extent of discernable radiation effects on the local population is statistically significant.

The relatively small number of studies that contradict these results are inevitably conducted by researchers not employed by the Department of Atomic Energy. The first such was done by N. Kochu Pillai and his colleagues at the respected All-India Institute for Medical Sciences, published in *Nature* in 1976, which found a higher prevalence of Down’s syndrome among this population than comparable groups.¹² This led to a heated rejoinder by a DAE scientist, questioning the study’s conclusions, including inappropriate comparisons with European control groups, which Kochu Pillai responded to.¹³ Most recently, a group of

⁸ M.P.Chougaonkar, et. al., “Profiles of doses to the population living in the high background radiation areas in Kerala, India,” *Journal of Environmental Radioactivity*, 71 (2004): 275-297; A. C. Paul, et. al., “Population Exposure to Airborne Thorium at the High Natural Radiation Areas in India,” *J. of Environmental Radioactivity*, vol. 40, 3, (1998): 251-259.

⁹ One study particularly bears mention because of its discovery that exposure to radiation and cancer rates were inversely correlated, suggesting a “hormesis” hypothesis; in other words, radiation exposure could be considered homeopathic in relation to cancer incidence! K.S.V. Nambi and S.D. Soman, “Further Observations on Environmental Radiation and Cancer in India,” *Health Physics* 59, 3 (Sept. 1990): 339-344.

¹⁰ M. Krishnan Nair, et. al., “Population Study in the High Natural Background Radiation Area in Kerala, India.” *Radiation Research*, 152, Dec. 1999 (6 Suppl.): S145-148.

¹¹ V.D. Cheriyan, et. al., “Genetic monitoring of the human population from high-level natural radiation areas of Kerala on the southwest coast of India. II. Incidence of numerical and structural chromosomal aberrations in the lymphocytes of newborns,” *Radiation Research* 152, Dec. 1999 (6 Suppl.): S154-158. A study by Forster et. al. offers another interpretation of this finding in “Natural radioactivity and human mitochondrial DNS mutations,” *Proc. of the Nat. Acad. of Sciences (US)*, vol. 99, 21 October 2002: 13950-13954.

¹² N. Kochupillai, et. al., “Down syndrome and related abnormalities in high background radiation area in coastal Kerala,” *Nature* vol. 262 (1976): 60-61.

¹³ K. Sundaram, “Down’s Syndrome in Kerala,” *Nature*, vol. 267 (3 June 1977), p. 728.

researchers led by V. T. Padmanabhan of the Centre for Industrial Safety and Environmental Concerns, a Kochi-based NGO, associated with Green Audit, a UK-based environmental NGO that “monitors the performance of companies and organizations whose activities might threaten the environment and the health of citizens,”¹⁴ published their own cohort study, based on a survey of 70,000 subjects, with data collected from 1988-1994.¹⁵ This is the largest non-governmental study conducted to date, and is comparable in size to the DAE studies. This study stands out, apart from its size, for its recognition of and effort to control for the effects of migration into this community.¹⁶

Padmanabhan’s study, which focuses on heritable anomalies, finds that the residents of the high background radiation area do in fact exhibit patterns of genetic transfer across generations quite distinct from populations living in low background radiation areas. The factor of migration also turns out to be quite significant: when combined with consanguineous marriage, the likelihood of heritable anomalies and “death of offspring” become statistically significant. Among the group that (a) lives in the high radiation area and (b) have married a blood relative, the “excess relative risk” of having a child die or be born with anomalous genetic factors rises to 169% when compared to couples who live in low radiation areas and when at least one partner originates from outside this region. The study does not break down the relative importance of location and genes in affecting anomalous outcomes, but notes that these conditions are present in spite of improved primary health conditions and reduced exposure to radiation due to the increased prevalence of houses using modern construction materials.¹⁷ In all, this study offers a number of robust rejoinders to the findings of many DAE-sponsored studies, indicating (if nothing else) circumstantial evidence for correlation between the source of funding and the nature of the results.

Another way of reading these studies is to consider the category of the population, understood as, in Hacking’s terms, “part of the technology of power in a modern state.”¹⁸ DAE studies are strikingly consistent in describing the social profile of the people living in the rare earths zone. They describe a distinct and separate community that has been long-resident in this region, is largely lower caste and multi-religious, and whose traditional occupation is fishing.¹⁹ The image of isolation is buttressed by noting that the high radiation area is separated from low radiation areas by natural boundaries including a lagoon and narrow canals. Rarely is any mention made of the mining activity that takes place in this area. Mining rare earths is of course the main reason why the Indian state – and the world

¹⁴ <http://www.greenaudit.org/>. Accessed Jan. 17, 2006.

¹⁵ V. T. Padmanabhan, et. al., “Heritable anomalies among the inhabitants of region of normal and high background radiation in Kerala: results of a cohort study, 1988-1994.” *International Journal of Health Services*, vol. 43, no. 3 (2004): 483-515. The study was funded by the “World Council of Churches, Geneva; X minus Y, Amsterdam; HEKS Zurich; and Mme. Solange Fernex, Beiderthal, France” (p. 510).

¹⁶ It is fairly obvious that if the history of social movement is not considered, the results of any survey seeking to examine the implications of long term exposure to background radiation would be flawed, as the data would include both recent immigrants and longer term residents in the same pool.

¹⁷ Chougankar, 277-8.

¹⁸ Ian Hacking, “What should we do with the history of statistics,” in *The Foucault Effect: Studies in Governmentality* eds. Graham Burchell, Colin Gordon and Peter Miller (Chicago: University of Chicago Press, 1991): 181.

¹⁹ Certain kinds of generalities, even stereotypes, abound in these studies: for instance, “in tropical regions such as India where houses are well-ventilated...” By contrast, Kochu Pillai, et. al. notes that “the floor area of these huts did not exceed 200 sp. ft., and there was much overcrowding and poor ventilation.” “Nodular Lesions in the Thyroid in an area of High Background Radiation in Coastal Kerala, India,” *Indian J. of Medical Research* vol. 64, 4 (April 1976), p. 539.

beyond, as evidenced by Bugher's report -- is such a presence in this geographically and socially marginal area.²⁰ DAE studies repeatedly make a point of noting that this region has been populated for 1,000 years and that there is little migration in any direction.²¹ One study boldly asserts: "There is hardly any migration into or outside the area, except that some of the youth have gone to gulf countries seeking jobs, but they come back regularly; otherwise people have lived there for generations."²²

When these unrealistic assertions are questioned, however, very different results emerge. The non-DAE studies, particularly those conducted by Padmanabhan, describe a far more complex social and historical community. Apart from migration, which leads to far more ominous findings than the DAE studies, Padmanabhan points out that this area is distinct for reasons quite different than have been mentioned. In two separate studies he notes the importance of a Norwegian technology and aid mission set up in the 1950s, which led to a higher proportion of mechanization among the fishermen in this region compared with other coastal fishing communities, and which also brought with it a hospital, which gave the residents access to better primary health care than was available elsewhere.²³ The mining industry gave local residents access to higher paid employment possibilities than either fishing or agricultural labor, suggesting that this is actually a relatively well off community in comparison with other nearby non-urban areas.

The population represented in government studies is closed, bounded, well-defined, relatively impoverished, and, statistically, not unwell. The same population described in competing studies includes migrants, has been exposed to international development efforts (the Norwegian fisheries project was the first international development project in independent India), has long had access to relatively better health care and receives higher incomes, on average, than surrounding areas. They also suffer the effects of exposure to high levels of radiation, expressed through cancers, heritable anomalies, and other conditions.

What is common to both accounts, state and oppositional civil society, is the idea of the population. The residents of the rare earth sands are primarily identified as a bio-medical entity whose identity is defined in relation to the degree of exposure to radiation and the outcomes that can be measured from them. Their existence competes with what "really" matters to scientists and the state, respectively: a naturally occurring belt of high background radiation, and, valuable atomic material. While there is little question about the ameliorative intent of the civil society intervention, the object of such studies is to force the state to adopt a stance of responsibility through the publication of data and evidence that is academically and scientifically credible. Yet, from an academic standpoint, the two sets of studies cannot be compared. The design of the research, the boundaries of the population, and the stated

²⁰ The place of women in these studies is ambiguous: it is not clear whether they are economically inactive or that they do not have employment in the formal sector. Due to taboos prevalent in South Indian fishing communities, women are proscribed from going to sea, hence, a division of labor emerges where men catch fish and women are in charge of cleaning and selling them. Kalpana Ram, Mukkuvar Women: Gender, Hegemony and Capitalist Transformation in the South Indian Fishing Village (New Delhi: Kali for Women, 1992).

²¹ Cheriyan, "Genetic Monitoring," S154. Also, Jaikrishnan, "Humans have been living in this area for 1,000 years." S149. The origins of this date appear to be a study by Weiss (1966) that I have yet to acquire. Referenced in Y. R. Ahuja, et. al., "Evaluation of effects of high natural background radiation on some genetic traits in the inhabitants of the Monazite belt in Kerala, India," Human Biology vol. 45, 2, p. 168.

²² Krishnan Nair, "Population Study," S145.

²³ "Radiation-caused genetic diseases at Chavara-Neendakara in Kerala, India: The anatomy of a non-debate," International Perspectives in Public Health, 3, 1, (Spring 1987), pp. 20-25.

intent of the surveys together produce accounts that end up reinforcing the prevailing interests of the parties concerned. Both share in a discourse that seeks to define, in terms of the collective, the parameters that are significant and worthy of attention. This is biopolitics at work: what does not change is the marked imbalance of power between state and civil society.

DAE studies' discursive emphasis on the long historical record of human habitation in this region seeks to reinforce the idea that this is not a recent or "man-made" disaster, but a natural phenomenon for which no one can be held "responsible." The emphasis on long-term residence provokes the seemingly self-evident proposition that if this region suffered from severe environmental danger, would "rational" people have continued to live here for generations? Since they have been here for that long, in other words, it could not be that dangerous. The anxiety being covered up here is the possibility that there is a statistically valid link between residence in the monazite belt and bio-medical ill health. Such a link would force the state to acknowledge some responsibility for ameliorating these problems: responses might have to include transfers of residence, financial compensation, and access to advanced medical treatment.²⁴ The issue is more than the money involved. The Indian state is loath to acknowledge the etiology of suffering described by Padmanabhan and others because of the privileged place of atomic energy in the discourse of national prestige, hence, it firmly resists the association of India's highly valued atomic resources with bio-medical un-health in all possible ways.²⁵

A critical difference between the earlier experimental view and the public health view lies in the now-overt presence of the state. The state is present as an actor who is directly involved in mining activities as well as an ideological agent, the prime representative and ultimate guarantor of the public good. Its presence takes the form of surveillance (for political enemies and negative health effects), intervention (to offer the message that this region is safe and the country's expectations of technological development will be met), and, care (regular health testing, provision of cheap or free medical facilities, amelioration of the condition of those directly exposed to radiation). An important new relation is founded between the once-experimental subjects and the state, summarized by Adriana Petryna as a claim to "biological citizenship."²⁶ The state does not have untrammled power to decide matters of life and death, indeed it often has little choice but to act in ways that appear to be responsible; but it also has, through the provisions of national security, the ability to act unilaterally. Sovereign, disciplinary, and biopolitical power are all on display here.

When Bodies Disappear

²⁴ But it is worth noting that all of these responses were put into place following the 2004 tsunami which was, unquestionably, a natural disaster.²⁴ What also makes the difference between the two "natural" disasters is the time period involved, the sudden, dramatic, visible effects of the tsunami versus the creeping, slow, ongoing character of background radiation. See Srirupa Roy, "The Politics of Death," in Itty Abraham, ed., *South Asian Cultures of the Bomb* (Indiana, 2009) for an illuminating discussion of comparative disasters.

²⁵ See Arthur Kleinman, Veena Das and Margaret Lock, eds., *Social Suffering* (Berkeley: University of California Press, 1997). Itty Abraham, *The Making of the Indian Atomic Bomb* (London: Zed Books, 1998)

²⁶ "A massive demand for but selective access to a form of social welfare based on medical, scientific, and legal criteria that both acknowledge biological injury and compensate for it." See *Life Exposed: Biological Citizens after Chernobyl* (Princeton: Princeton University Press, 2002), p. 3

The local Regional Cancer Center (RCC) unit lies in a small complex of single story weather beaten cement buildings off the main road connecting Chavara to Kollam. Running parallel to the road, marking the far boundary of the rectangular complex, is a large seawall built after the tsunami. Small houses belonging to fishing families hug the seawall and the small beach beyond it. The RCC inherited this complex from the Indo-Norwegian Fisheries project, Norway's first-ever overseas aid project, which ended in the 1960s. In one corner of the complex is the Palliative Care facility. Run by a handful of nurses with a single doctor in attendance, this facility contains a dozen or so beds where patients in the final stage their lives are looked after. The Palliative Care facility is small and under-equipped. But the level of care and concern for these dying patients is palpable, even to the very short-term visitor. The young doctor in charge has no illusions about what he does. "To die is natural. We have prepared them for this. They know what to expect." These grim statements are belied by the enormous compassion with which he talks to the families of his patients. "They are the ones who really suffer."

One third of the people we spoke with knew 4 or more people from their neighborhood who had died of or were suffering from cancer. 87% knew at least one. 84% of the interviewees knew at least one person suffering from some form of mental retardation. The most common cancers affected the mouth, uterine, brain, and blood. Most people in this area had heard of radiation, but understandings of it varied considerably. For many, especially the less well formally educated, radiation was represented most often as "current", the English word, and powerful "electric rays", both describing an invisible force all around them. "Current" appeared when the sands were disturbed or mined. The association of electricity and radiation was repeated by a number of people, either as analogy or as identity. IRE sand mining was identified as a cause of cancer by 31% of the respondents. 42% had no idea what causes cancer. Far more people from Tamil Nadu said they did not know where radiation came from, even though they had heard of it. In Kerala the link between the ground, mining, and radiation was clear to a number of people, whether expressed in formal or informal terms. Overuse of mobile phones, pungent black smoke drifting overhead from the tall IRE smokestack and long industrial pipes whose unknown, but presumably toxic, contents had leaked into the soil were also explicitly identified as causes of ill-health in this region. Residents took recourse to allopathic, homoeopathic, and ayurvedic medicine in response to ill-health. About 20% knew that radiation was used to treat cancers, but few could make the link between "current" from the black sand and the medical treatment.

I also met with two retired senior officials of Kerala Mining and Minerals Limited. We met in a modern house in an outlying area of Kollam. They were proud of their work and keen to share with me their mutual sense of professional achievement. Toward the end of the conversation, which had been lively and cheerful, the question of radiation exposure came up. At once the mood became much more somber. I had the feeling that I was listening in on a very private conversation that they shared with few other people, including colleagues. "It has probably happened," one of them said, "we have been around [radioactive materials] for so long, and even handled [these materials] in our hands". He looked around at his house, and pointed with his shoulder at the curtain behind which we could hear his wife in the kitchen. "We have done these things in order to make all this possible ... but at least our families have not been exposed to it."

Conclusion

“Death was no longer something that suddenly swooped down on life--as in an epidemic. Death was now something permanent, something that slips into life, perpetually gnaws at it, diminishes it and weakens it.”

Michel Foucault, “Society Must be Defended,” p. 244

What do we make of the condition that ensues once the once-inviolable distinction between life and death gets confused, when death has “slipped” into life? To call it the biopolitical condition only begs the question, for, as Foucault is careful to note, biopolitics does not *replace* other forms of power, whether sovereign power over life or disciplinary regulation of behavior, it “infiltrates” them (242). How do we understand the condition of being that ensues if death does not follow life but “perpetually gnaws at it, diminishes it and weakens it” on a terrain produced by the *simultaneous* exercise, expression, and experience of biopolitical, disciplinary, and sovereign expressions of power?²⁷

In the final chapter of Society Must Be Defended, where Foucault first introduces the idea of biopolitics, he explicitly links this new mode of political life with a historical time period: (he mentions both the second half and end of) the 18th century. If the 17th and 18th centuries saw the rise of disciplinary power that monitored and controlled the somatic self, by contrast, biopolitical power seeks to assess and gauge the health of the social collective through such demographic macro-indicators as the “ratio of births to deaths, the rate of reproduction, the fertility of a population... [etc.]” The intent, if one may call it that, of biopolitics is to identify the outliers, the anomalous conditions, the disruptions to the equilibrium of the whole. This is the “power of regularization ... [that] consists in making live and letting die.” (247) Foucault argues that biopolitical power targets the “global mass” or “man-as-species,” and thereby inaugurates the idea of the *population*, whose vitality can and must be measured in varieties of ways. As a historical argument there is much to celebrate from these insights, but Foucault is curiously silent about politics. Populations are, by definition, bounded entities: surely the foundational political act that precedes this discussion is marking the spatial limit of the “global mass.” A necessary condition for the emergence of biopolitics, in other words, is the emergence of the modern nation-state, here France, with its defined territorial boundaries.²⁸

Once the idea of the bounded population whose collective health needs to be constantly measured and monitored is established, it comes as no surprise to realize that the biopolitical moment is inseparable from the birth of modern statistics (“political arithmetik” in its earlier Anglophone incarnation), the census, public health, insurance and actuarial sciences, forecasting, the idea of risk, and modern conceptions of security. Modern security, as Michael Dillon (1998) has pointed out, is always shadowed by the idea of insecurity. When security is defined as the absence of insecurity, the latter drives the former. Insecurity

²⁷ The simultaneity of the exercise, expression, and experience of such different regimes of power leaves us in a theoretical quandary. How does one distinguish them empirically; more crucially, how does one use such a sweeping articulation to understand the nature of subjectivities -- political and otherwise -- effected by modern power?

²⁸ Eugene Weber and Peter Sahlins both, in different ways, show how incomplete this boundary making process was for modern France.

introduces a set of state practices seeking to identify and control all manner of social threats. These threats need not necessarily be material, but need only to be imaginable: as a result, they are potentially limitless (Abraham 2008). Biopolitics, to put it differently, allows us to think about the human encounter with the idea of what Foucault has elsewhere called “radical” uncertainty, and is, in that sense, centrally concerned with an entirely new conception, the secular and collective *future* of a society.

This paper seeks to come to terms with the problematic engendered by this formulation: the idea of the future, and the idea of the population, both conditions emergent from the simultaneous exercise, expression, and experience of biopolitical, disciplinary, and sovereign expressions of power. There is a complex dialectic at work here: multiple temporalities are produced through the contradictions between this new idea of the future and the end of the traditional conception of the human life cycle (when death “infiltrates” life); contested spaces emerge between the effort of bounding space and the everyday meaning-giving activities of creating place from space. It is through the playing out of this dialectic that we may gain a better appreciation of the ontology of modern insecurity, glossed here as contemporary expressions of radical uncertainty.

From Place to Space

The core assumption of this paper is that coming to terms with the dialectic of future and population cannot proceed without an interrogation of the spatial terrain on which the regime of modern power is exhibited. When temporality is confused by the simultaneous presence of life and death, it is through the spatial frame that we may understand better what is meant by death’s coterminous presence alongside the technologies of modern power. Living -- however attenuated -- and dying -- however commonplace -- must take place somewhere and it is that “where” that we must turn our attention to.

What transforms space into place are the everyday actions of the living (Feld and Basso 1996, Hirsch and O’Hanlon, 1995). The meaning- and memory-giving actions of the daily encounter with the social and the spatial is what makes space into place: in its most banal form, these are the actions that make dwellings into homes, what makes trees into gods, what makes mountain paths into illicit migration routes. For the phenomenologist Edward Casey, “Far from being dumb or diffuse, the lived body is as intelligent about the cultural specificities of place as it is aesthesiologically sensitive to the perceptual particularities of that same place.” (1996: 34)

Consider this in relation to the problem of biopolitics. What happens to “place” when death infiltrates life? Memory of place no longer carries the meanings it once did, the institutions of social life begin to decay, culture begins to fall into ruins, the work of the body on space does not produce the comforts of home it once did; the *habitus* of community is, to borrow a phrase, gnawed, diminished and weakened. Place is being emptied of living and thus is less “emplaced” than it once was. This condition does not imply departure -- yet -- and is not the same as the dislocation of relocation (which would be the outcome of sovereign power); but it is also more than just the breakdown of communal harmony and bonds of cohesion. The invocation of departure is deliberate. Even if departure, in that most final sense of death

(though the body might still remain), is the end of the present moment, it is not yet here. The effect of a soon-to-be departed condition is a *spatial* immanence. What it means to empty place of life I will call (awkwardly) *unplacement* (by contrast with a Heideggerean-inflected emplacement). The playing out of the dialectic of future and population, the biopolitics of uncertainty and insecurity, is summarized as the immanence of unplacement. If biopolitics is ultimately about the future, its spatial manifestation is a place just barely here: where the body is still present but where memory and meaning are being emptied out, where departure and dematerialization await.