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V.I. Vernadsky and the noosphere concept: Russian understandings of society–nature interaction

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1. Introduction

The critical literature continues to question the meaning and relevance of sustainable development and its ability to address effectively the environmental consequences of nature–society interaction (e.g., [Dryzek, 1997](#) and [Eden, 2000](#)). Nevertheless, despite the concept's many detractors, it remains influential as a catch-all for informing national policy development around the globe, as evidenced by the World Summit on Sustainable Development held in Johannesburg during August–September 2002 (see also [World Bank, 2003](#)). Arguably, the concept's influence is mediated by cultural particularities and traits and therefore the interpretation given to the term 'sustainable development', and the means for its implementation, can vary between countries (e.g., see [Oldfield and Shaw, 2002](#) and [O'Riordan and Voisey, 1998](#)). While the underlying logic of the concept may remain unchallenged, with an insistence on the synergistic relationship between economic growth, social development and environmental improvement, a thorough exploration of national approaches to sustainable development has the potential to reveal significant differences from dominant Western conceptualisations. Therefore, there would seem much to be gained from a purposeful engagement with understandings of sustainable development in different regions of the world in recognition of their potential to augment debate as well as structure national development paths. By extension, alternative understandings of the concept found within different layers of society (e.g., academic communities, indigenous peoples etc.) are also worth examining more closely. In other words, it is important not to allow a general dissatisfaction with the effectiveness of the concept to hinder a critical analysis of coexisting knowledges operating within different cultural contexts. Indeed, serious engagement with such difference promises to contribute significantly to the ongoing theoretical critique in the more general area of society–nature interaction.

This paper builds on previous work concerning Russia's interpretation of sustainable development as outlined in its official documentation ([Oldfield, 2001](#) and [Oldfield and Shaw, 2002](#)). Russia's importance in global environmental affairs ensures that an exploration of its domestic environmental policy has significance beyond mere intellectual curiosity. The uncertainty surrounding the viability of the Kyoto Protocol, prior to its ratification by Russia in October 2004, is indicative of this importance. Furthermore, it is clear that Russia will continue to play an influential role in global environmental affairs during the short- and medium-term. The particular focus of this paper is the work of the Russian scientist Vladimir Ivanovich Vernadsky (1863–1945) and his biosphere–noosphere model of evolutionary change, which is referenced in recent legislative and policy documents.¹ It is not the intention of the paper to posit Vernadsky's ideas as an effective response to the problems surrounding the linkages between society and nature. Indeed, the vast scope of his work ensures

that there is much to critique and question and some of these concerns are raised in the body of the paper. Rather, the aim is to explore Vernadsky's ideas in an attempt to further our understanding of the way in which Russia is approaching the issue of sustainable development in the contemporary period. Furthermore, the concluding section of the paper suggests that the scope of Vernadsky's biosphere–noosphere conceptualisation can be used to stimulate the search for a more coherent approach to work in areas of sustainable development and sustainability across the span of the social and physical sciences.

2. Russia, sustainable development and the noosphere

Recent Russian legislation and official documentation allude to aspects of Russian culture which are deemed significant for the effective implementation of sustainable development in the long-term ([Oldfield, 2001](#) and [Oldfield and Shaw, 2002](#)). These particularities range from alleged affinities between the central tenets of sustainable development and Russian cultural traditions to explicit mention of the work of the aforementioned Russian scientist Vladimir Ivanovich Vernadsky in policy documents. The extent to which Russian cultural traditions coincide with contemporary concerns for holistic understandings of society–nature interrelations and sustainability is a complex and highly contestable issue.

One of the earliest explicit mentions of Vernadsky's work in Russia's official documentation is found in the 1996 Presidential decree (*ukaz*) 'Concerning the Concept of Russia's Transition to Sustainable Development' (see [Oldfield, 2001](#) and [Oldfield and Shaw, 2002](#)). The final section of the decree provides an outline of what are seen as the necessary stages of this transition process and compares the attainment of sustainable development with the emergence of the noosphere (sphere of reason)² as outlined by Vernadsky '...when the spiritual values and understanding of humankind, existing in harmony with the environment, will become the principal criterion of national and individual wealth' ([Ukaz, 1996, p. 5](#)). This reference to Vernadsky and the noosphere has been retained in the subsequent draft State Strategy for Sustainable Development³ (see [Zelenyi mir, 2002](#)) together with affiliated documentation such as that produced for the 2002 World Summit on Sustainable Development in Johannesburg (see [Shelekhov, 2002](#)). These documents equate the establishment of the noosphere with a fundamental and qualitative shift in the nature of Russian society from one based on 'economic and material values' to one founded on 'ecological and spiritual–moral values'. A more detailed analysis of these policy documents is made below. For now it is worth noting that the rather brief allusions to the noosphere within such documents raise a number of issues. In particular, it is unclear exactly what is meant by the noosphere and what mechanisms exist to facilitate its emergence. Furthermore, it does not necessarily follow that the interpretation of the noosphere proffered within these official documents represents an accurate rendering of Vernadsky's own work and ideas. At the same time, it can be argued that the general representation of Vernadsky as a key environmental figure in official documentation might have considerable advantages for a country characterised by a strained contemporary environmental

situation and a complicated environmental past. In this context, the particularities of Vernadsky's ideas as well as the accuracy of their interpretation would probably be deemed less important by the Russian authorities than the broader project of cultivating a positive environmental image at the international level.⁴ Suffice to say that the noosphere concept has symbolic importance for certain sections of Russian society and is typically associated with imprecise notions of society–nature balance. The following section explores Vernadsky's understanding of the noosphere and the related biosphere concept in more detail and is based on an analysis of his original writings. This is then followed by an overview of the way in which the noosphere idea has been interpreted within academic and policy-making circles during the Soviet and post-Soviet periods. The final part of the paper indicates some of the ways in which Vernadsky's ideas might be used to augment our own understandings of society–nature interaction.

3. Vernadsky and the biosphere

In order to gain a greater understanding of Vernadsky's noosphere concept, it is necessary to begin with an exploration of his work on the biosphere. Indeed, for Vernadsky, the noosphere is the latest phase in the evolutionary and qualitative transformation of the biosphere ([Vernadsky, 2001b, p. 344](#)).⁵ Vernadsky's work on the biosphere reflects a holistic interpretation of the interaction between living and non-living matter within a cosmic framework. This sensitivity to the interconnectedness of living and non-living matter can be attributed, at least in part, to the academic milieu in which he matured as a young scholar. During the early part of his intellectual development, Vernadsky studied under the tutelage of A.M. Butlerov, V.V. Dokuchaev, and D.I. Mendeleev ([Bailes, 1990, pp. 17–18](#)).⁶ It is a moot point as to the precise extent to which these three scientists influenced Vernadsky's later ideas. Nevertheless, the holistic approach characterising Dokuchaev's work on soil formation and conservation in Russia's steppe region was certainly an important stimulus for the later development of Vernadsky's understandings of 'natural' systems ([Lapo, 1987](#) and [Bailes, 1990](#)). Towards the end of the 19th century, while still in the early part of his academic career, Vernadsky pursued interests in the fields of mineralogy and crystallography and extended his knowledge in these areas by spending time in European universities ([Bailes, 1990, p. 37](#)). The insights gained from such activities would lay the foundations for his later establishment of biogeochemistry as a new field of scientific enquiry ([Bailes, 1990, pp. 186–87](#)). From these early years, Vernadsky was immersed in extensive international networks of scientific collaboration and dialogue. His work on the biosphere provides clear evidence of his awareness and knowledge of intellectual trends and developments both in Europe and beyond (see [Vernadsky, 1998](#)).

The Austrian geologist Eduard Suess is credited with being the first to employ the term 'biosphere' in order to distinguish the Earth's zone of organic life ([Smil, 2002](#)).⁷ However, Vernadsky extended and developed its meaning considerably and gave the biosphere a firm scientific grounding via a detailed exploration of its internal characteristics and structure. He published the major findings of this research in his book 'The Biosphere' during the 1920s.⁸ This work was divided into two distinct

sections. The first, entitled 'The biosphere in the cosmos', established the biosphere as a complex phenomenon powered by the sun and intimately connected with the Earth's geological processes. A key element of Vernadsky's insight was his assertion that the '[T]he biosphere may be regarded as a region of transformers that converts cosmic radiations into active energy in electrical, chemical, mechanical, thermal and other forms' ([Vernadsky, 1998, p. 47](#)). Furthermore, it was the production of free energy which gave the biosphere its extraordinary planetary role ([Vernadsky, 1998, p. 44](#); see also [Smil, 2002, p. 6](#)). He then proceeded to underline the importance of 'living matter' as the key transformer of the sun's energy 'into the active chemical energy of the biosphere' ([Vernadsky, 1998, p. 50](#)). The second part of the work (entitled 'The domain of life') explored the extent and range of life within the biosphere from the deepest ocean to the upper reaches of the atmosphere. Space precludes a full engagement with Vernadsky's biosphere concept, but the works of [Lapo \(1987\)](#) and [Smil \(2002\)](#) provide detailed overviews and critiques of his ideas in this area.⁹

Vernadsky's elaboration of the biosphere concept has been acknowledged as a significant piece of work by a range of Western scientists due to its broad synthesis of hitherto disparate elements and intuitive leaps (see [Margulis and Sagan, 2000](#), [Oldroyd, 1996](#) and [Westbroek, 1992](#)). At a general level, Vernadsky attempted to provide a framework for integrating the activities of the biosphere or 'living layer' with the Earth's geological processes. Life is often portrayed as a rather ephemeral process, which must adapt to the physical limitations imposed by the Earth's geology and chemistry in order to survive and reproduce. However, Vernadsky developed an understanding of the way in which seemingly transient life processes were in fact responsible for fundamental changes in the chemical structure of the Earth. It was not so much the individualised and (geologically) insignificant activity of a single organism which formed the basis of his insights but more the cumulative effect of living matter more generally. Vernadsky's use of language is also important. Rather than referring to 'life', he employed the term 'living matter' (*zhivoe veshchestvo*) which he took to refer to '...the totality of all organisms present on the earth at any one time' ([Vernadsky, 1945, p. 1](#)). According to [Margulis and Sagan \(2000, p. 50\)](#), this emphasised the fact that 'life was less a thing and more a happening, a process'. Furthermore, Vernadsky noted that the concept of 'life' was often confused by its association with philosophical and religious thinking and this contrasted with the scientific precision he attributed to the term 'living matter' (e.g., [Vernadsky, 2001b, p. 339](#)). Vernadsky's emphasis on the geochemical influence of living matter provided the basis for his inferences concerning 'life as a geological force' which highlighted the global ramifications of life processes by means of the recycling of important chemicals and the active maintenance of chemical imbalances within the biosphere. This approach has similarities with the conceptual framework put forward by Lovelock in his Gaia theory 50 years later ([Lovelock, 1979](#)), although Lovelock was clearly unaware of Vernadsky's work at the time of his writing (see [Lapenis, 2002](#), [Lovelock, 2000](#) and [Margulis et al., 1998](#)).

As indicated above, Vernadsky conceptualised the biosphere within an evolutionary framework. [Lapenis \(2002, p. 384\)](#) suggests that Vernadsky's understanding of the biosphere reflected a belief in 'directed evolution' whereby the evolutionary process proceeds in a direction generally favourable

to life.¹⁰ In addition, he believed that the underlying momentum of the evolutionary process was towards the increasing sophistication of perceptual faculties epitomised by humankind's emergent mental capabilities and he grounded this understanding in the work of scientists such as James Dwight Dana (cephalisation process) and Joseph LeConte (establishment of the psychozoic era) ([Vernadsky, 2001b, p. 341](#) and see also [Smil, 2002, pp. 12–13](#)). Vernadsky explored the growing importance of human activity in geological history and suggested that the development of humankind's consciousness and 'collective reason' (*kollektivnyi razum*) was playing an increasingly fundamental role in the evolutionary dynamics and transforming potential of the Earth's geochemical processes ([Vernadsky, 1994, p. 348](#) and see [Vernadsky, 2002](#)). Furthermore, he considered that as a consequence of this '[T]he biosphere of the 20th Century [sic] is being transformed into the noosphere which has been created above all by the growth of science, scientific understanding and the social activities of humankind based on such understanding' ([Vernadsky, 2002, p. 274](#)). Crucially, while he associated humanity's growing geological influence with the emergence of socialised scientific thought ([Vernadsky, 2002, p. 252](#)), he simultaneously cast doubt on the agency of philosophical and religious thought due to their alleged explicatory deficiencies ([Vernadsky, 2002, p. 253](#)). He compared the importance of the purported noospheric development with major geological events of the past such as those associated with the emergence of calcium-rich organisms and green forests ([Vernadsky, 2001b, p. 344](#)). The qualitative difference between these evolutionary phases and the emerging noospheric phase, however, was the key transformative role to be played by scientific thought (e.g., [Vernadsky, 2002, pp. 380–381](#)).

Following his earlier work on the evolution of the biosphere, Vernadsky conceptualised scientific thought cumulatively as a new type of biogeochemical energy having the potential to influence fundamentally the geological evolution of the Earth. This insight was derived from his more general observation that human activity is historically associated with the emergence of a new form of energy operational within the biosphere, which he labelled the 'energy of human culture' or 'cultural biogeochemical energy' ([Vernadsky, 2002, pp. 387–389](#)). Vernadsky did not confine the emergence of such energy exclusively to humankind but instead conceptualised it as a function of the mental development of organisms more generally. Nevertheless, the fundamental transformation from the biosphere to the noosphere he saw as possible only with the concomitant emergence of scientifically grounded reason ([Vernadsky, 2002, p. 387](#)). The attendant 'culturalisation' process is at the heart of the transformation of the biosphere to the noosphere and is associated with a marked change in the appearance of the Earth's crust. Thus, for Vernadsky, the noosphere was more than a symbolic label used to capture the essence of humankind's growing ability to alter and change the Earth's surface. It was an evolutionary stage with considerable historical depth, complexity, and inherent inertia. There was a certainty about its emergence beyond the whim of humankind and bound up with multifarious biogeochemical interactions taking place over the course of evolutionary time. For example, writing in 1938 he suggested that

'...the restructuring of [the biosphere] by scientific thought through organised human labour is not an accidental phenomenon dependent on the will of humankind, but an elementary natural process

with deep roots prepared by an evolutionary process with a duration of hundreds of millions of years' ([Vernadsky, 2002, pp. 252–253](#)).

Following this line of thought, while the movement from the biosphere to the noosphere is not reducible to the conscious actions of humankind, the noosphere would nevertheless appear to represent an arena *within* which humankind has the potential and agency to play the defining geological role. It can be suggested that while Vernadsky was evidently optimistic about the abilities of humankind to rise to the challenge of such a demanding role he nevertheless recognised the ambiguities of human action and progress and the need to defend certain ideals in the face of adversity (e.g., [Bailes, 1990, p. 23](#)). [Levit \(2001, pp. 65–66\)](#) attempts to articulate the evident tension between Vernadsky's belief in directed evolution and the attendant uncertainties concerning the precise nature of this change by drawing on F. Ayala's notion of 'indeterminate natural teleology'. This is the idea that while the final state of the noosphere is not pre-determined in any precise way, the biosphere is nevertheless conceptualised as heading in a definite direction i.e., one generally favourable to life. All the same, Vernadsky's later work was imbued with a moral fortitude and optimism (see [Smil, 2002, p. 266](#)). For example, writing shortly before his death in 1945, as Hitler's army was being forced back by the combined Allied forces, he suggested that

'[Humankind] can (*mozhet*) and must (*dolzhen*) reconstruct the domain of its life by its work and thought, reconstruct it radically in comparison with the past.'
([Vernadsky, 2001b, p. 343](#))

His optimism was more evident later in the same article where he reflected

'...that our democratic ideals are in unison with the elemental geological processes, with the laws of nature, and are answerable to the noosphere. It is possible therefore to view our future confidently. It is in our hands. We will not let it go' ([Vernadsky, 2001b, p. 344](#)).

Ultimately, Vernadsky's attempts to justify the purportedly lawful process of biospheric transformation into the noosphere have received criticism. To some extent this reflects the fact that Vernadsky died before he was able to pursue the connections between the biosphere and noosphere in more detail.¹¹ Nevertheless, it is worth noting some of the main objections here. In particular, [Levit \(2001\)](#) questions the nature of the transformation process itself and directs much of his censure at Vernadsky's underlying assumptions. For example, he suggests that there is limited evidence supporting the 'inevitable' evolution of intelligence associated with the development of science and scientific thought ([Levit, 2001, p. 76](#)). Furthermore, while scientific knowledge may result in the 'increased biogenic migration of atoms' within the biosphere (Vernadsky's second principle of biogeochemistry [see also [Levit, 2001, pp. 62–63](#)]), this principle of biogeochemistry cannot be elevated to that of a universal law of nature ([Levit, 2001, pp. 75–76](#)).¹² In other words, Levit suggests

that Vernadsky's posited transformation process is based largely on empirical generalisations, which are not necessarily supported by natural laws.

It is perhaps useful at this point to note that Vernadsky was not alone in utilising and developing the notion of the noosphere. The collaboration between Vernadsky and Pierre Teilhard de Chardin in addition to the philosopher Edouard Le Roy during Vernadsky's stay at the Sorbonne in the 1920s is well-documented (e.g., [Bailes, 1990, p. 162](#)). Indeed, the first usage of the noosphere term is credited to Le Roy. However, it is the ideas of Pierre Teilhard de Chardin which have received most attention in the West.¹³ Pierre Teilhard de Chardin's spiritually and religiously informed understanding of the noosphere, outlined in his 1959 book 'The Phenomenon of Man' ([Teilhard de Chardin, 2002](#)) provoked mixed responses from contemporary leading academics, while at the same time achieving popular success (e.g., [Simmons, 2000](#)). In later works (e.g., [Teilhard de Chardin, 1964, p. 157](#)) Teilhard advanced his understanding of the noosphere, referring to it as 'the terrestrial sphere of thinking substance' and relating it to the development of humankind through evolutionary time. Having aroused such a strong and mixed response in the West, it is often difficult to move away from Teilhard de Chardin's interpretation of the noosphere. Nevertheless, while it is important to be aware of the different interpretations attached to the noosphere concept, the strong similarities between the approaches of the three named scholars should also be noted. They were all trying to account for the remarkable phenomenon of humankind and, furthermore, to do this within a scientific framework. Writing in the late 1920s, Le Roy noted the discrepancy between humankind's relatively insignificant zoological role and its marked ability to influence the surrounding environment. He suggested that 'humanity is systematically much more biologically potent than it should be' ([Le Roy, 1999, p. 60](#)). Vernadsky and Teilhard de Chardin were both interested in establishing a general theory of life based on empirical generalisation ([Levit, 2001, p. 80](#)). But, whereas Vernadsky grounded much of his work on an understanding of biogeochemistry, Teilhard de Chardin employed his detailed knowledge of palaeontology ([Teilhard de Chardin, 2002](#)).

4. Vernadsky and his scientific legacy

Despite Vernadsky's limited influence in the West, his ideas proved popular in the Soviet Union. Vernadsky himself appeared ambivalent to the activities of the Bolsheviks, although he clearly disagreed with many aspects of the Soviet regime ([Bailes, 1990, pp. 142–144, 165–166](#)). The early Soviet administration, while wary of Vernadsky's views, was nevertheless respectful of his knowledge and scientific standing. As [Bailes \(1990, p. 163\)](#) comments '[T]he standard Soviet interpretation of Vernadsky in the 1930s was that he was a brilliant scientist but a poor politician and philosopher'. Indeed, his ideas on the biosphere found acceptance with a range of contemporary thinkers and scientists due to their compatibility with materialist philosophy. An additional indication of the wide sweep of Vernadsky's ideas is reflected in the overlap between of A.A. Bogdanov's work on systems theory (*tektology*) and Vernadsky's understanding of the biosphere ([Gare, 1996, p. 123](#)). Similarly, Nikolai Bukharin's attempt to advance the 'practical

materialism' of Stalin was apparently influenced greatly by Vernadsky's work on the biosphere and its emphasis on the connectedness of living matter and the relative place of humankind ([Foster, 2000, p. 228](#)).

Vernadsky died in 1945 and yet his ideas continued to motivate and inspire Soviet scientists. In particular, his work on the biosphere was increasingly well received during the 1950s and 1960s due to its potential to broaden the materialist viewpoint of Marxism–Leninism and its relevance for addressing environmental issues ([Bailes, 1990](#) and [Trusov, 1969](#)). However, as [Bailes notes \(1990, p. 181\)](#), Vernadsky's ideas tended to be used in a piecemeal manner in order to suit a particular viewpoint. While Vernadsky's work concerning the biosphere received much attention, the noosphere idea was also prominent. [DeBardleben \(1985, pp. 92–93\)](#) provides an overview of Soviet scientific debate during the 1960s and 1970s concerned with determining the capacity of natural systems to assimilate human intervention and notes the associated employment of Vernadsky's noosphere concept in addition to competing ideas such as that of the 'biotechnosphere'.

The noosphere concept continues to stimulate scientific debate in the post-socialist period. [Nikolaev \(1996, p. 11\)](#) suggests that while some scholars consider it the 'founding law of social ecology' others believe it to be a 'lucid, yet uncertain dream'. At the same time, [Yanshina \(2000, p. 638\)](#) implies that utopian interpretations of the noosphere are typically the result of unfamiliarity with the original work of Vernadsky. The noted ease with which Vernadsky's noospheric vision complemented the utopian aspirations of communism arguably laid the foundations for contemporary misunderstandings of Vernadsky's ideas, with the former sometimes being conflated with the latter ([Oldfield, 2001, p. 105](#)).

5. The pursuit of sustainable development

In this section, we return to the Russian government's contemporary usage of Vernadsky's notion of the noosphere as an emergent property of the final stage of Russia's transition to sustainable development. Since its mention in the 1996 Presidential decree, subsequent policy statements have largely maintained the association. Arguably, two of the most important statements include the 1998 Draft State Strategy for the Sustainable Development of the Russian Federation (see [Zelenyi mir, 2002](#)) and the preparatory document for the 2002 Johannesburg World Summit for Sustainable Development Concerning the Scientific Basis for the Strategy of Sustainable Development ([Shelekhov, 2002](#)).¹⁴ Both of these documents begin by considering the historical development of society with respect to the biosphere, noting the tendency for increased levels of environmental degradation during the last century. More specifically, sustainable development itself is envisaged as achievable within an evolutionary perspective represented by a three-staged progression, although this pretension to evolutionary change is prescriptive in nature and not based on any scientific reasoning. The third and final stage of this progression is associated with a fundamental change in the value structure of Russian society and characterised by a move from a society based on

'material values' to one founded on 'spiritual–moral values' ([Shelekhov, 2002](#) and [Zelenyi mir, 2002](#)). Importantly, this shift is equated with the 'further noospheric orientation of societal development' ([Shelekhov, 2002, p. 20](#)). Strong associations are thus drawn between the final stage of the progression towards sustainable development and the emergence of the noosphere or 'sphere of reason' ([Zelenyi mir, 2002, p. 6](#)). Indeed, it is suggested that '[T]he noosphere – is the concluding stage of sustainable development, a desired future state of society which will ensure the ecologically acceptable influence of humankind on nature and the rationalisation of human needs' ([Shelekhov, 2002, p. 17](#)). This interpretation would seem problematic for a number of reasons. First, the nature of the noosphere and sustainable development concepts differs fundamentally. Vernadsky attempted to establish the noosphere as a lawful emergent stage of the biosphere's development based on prevailing understandings of energy flows and evolutionary change at the atomic level, although, as indicated above, the extent to which Vernadsky was successful in achieving this aim is debateable (see also [Levit, 2000](#)). In contrast, sustainable development is a far less sophisticated concept, lacking the historical depth and internal momentum of Vernadsky's noosphere and, in some cases, being little more than a vision of future nature–society harmony grounded, more often than not, on neo-liberal rhetoric of economic development and human agency. This is not to dismiss recent synergistic developments in various academic disciplines which have the aim of achieving sustainability in all its various guises. While there is no mature 'sustainability science' as such, there is arguably a reasonably coherent 'science of sustainability' (see [Clark and Dickson, 2003](#)). Furthermore, it is important to recognise that the pursuit of sustainable development has encouraged significant and substantive developments in areas of policy formulation and technological development and that these advances are indicative of the concept's potential to encourage a purposeful engagement with society–environment concerns (e.g., [Parris and Kates, 2003](#) and [WCED, 1987](#)). Nevertheless, the terms of reference for the successful implementation of sustainable development tend to include a market-based economy and functioning democracy. The contemporary usage of the noosphere idea is therefore inclined to obscure the fundamental evolutionary and materialist foundations of Vernadsky's biosphere–noosphere conceptualisation.

Second, the conceptual framework developed by Vernadsky lacks the certainty of future nature–society 'balance' embodied in the concept of sustainable development. In other words, the achievement of sustainable development is, more or less, a de facto achievement of nature–society equilibrium. This aspiration is itself riddled with contradictions not least because the current energy structure of human society, together with its bias towards carbon-based fuels, ensure that development can never be 'sustainable' in any meaningful sense over the medium- to long-term. More generally, the notion of 'harmonious balance', which permeates much of the environmental literature, fails to acknowledge the evident imbalance implicit within the functioning of global ecological systems.¹⁵ The emergence of the noosphere cannot be equated so easily with a state of 'balance' between society and nature. While the optimism of Vernadsky's final writings combined with his faith in the resourcefulness of science have already been noted, such optimism should not

cloud the logic of Vernadsky's own ideas. This suggests that the noosphere is a qualitatively new state of the biosphere in which humankind plays a primary geological role. However, the nature of this primary role is not pre-determined. It does not necessarily follow that the application of scientific thought and knowledge will result inevitably in more harmonious interactions between human society and the wider environment.

Third, according to Vernadsky the noosphere is not something to be initiated, created, or ushered in by the contrived actions of humankind. Instead, it is more accurately an emergent property of the evolutionary process of living matter and, as such, quite independent of human will. It is only within the noosphere that human consciousness and agency begin to play a determining role. In contrast, the attainment of sustainable development is entirely dependent upon the actions of humankind. As such, it would seem erroneous to conflate the emergence of a Vernadskian noospheric state with the attainment of sustainable development. In this instance, it is perhaps more appropriate to conceptualise Russia's staged transition to sustainable development as an example of a conscious attempt by humankind to respond to the enormous moral dilemmas posed by the emergence of a 'sphere of reason' and the corresponding ability of humankind to influence fundamentally the state of the biosphere.

6. Concluding remarks

Vernadsky's biosphere–noosphere concept has, superficially at least, much commonality with current concerns related to the growing significance of humankind at a global scale. An awareness of humankind's ability to influence the state of the environment is not restricted to the contemporary period but has a considerable history (e.g., [Glacken, 1956](#)). More specifically, geologists have long been sensitive to the geological power of humankind (e.g., [Crutzen, 2002](#), [Grinevald, 1996](#) and [Westbroek, 1992](#)). The noosphere concept can also be employed descriptively in order to refer to the growing level of interconnectivity characteristic of the globalising tendencies of contemporary society and the intensification of electronic-aided communication. In this respect, [Mattelart \(2002\)](#) highlights the way in which the ideas of Teilhard de Chardin concerning the noosphere were appropriated by advocates of a 'global society' and later associated with the growth of the Internet and associated technological advances. Other interpretations of the concept focus on its superficial association with the attainment of 'balance' between humankind and the surrounding environment (see [Samson, 1999](#)). It is this particular understanding that is most obvious in Russia's recent legislation and policy documentation concerning sustainable development. As such, it can be argued that the noosphere is being employed symbolically as a future utopia characterised by nature–society harmony and thus would appear somewhat disconnected from the scientifically-grounded approach towards the concept outlined by Vernadsky. At the same time, it was noted in the introduction that the more general emphasis on Vernadsky as a key environmental thinker has potential benefits for a country with Russia's poor environmental record in helping to alter its image at the international level. Vernadsky arrived at his interpretation of the concept via a detailed

understanding of global evolutionary change through geological time, and he believed the noosphere to be an inevitable emergent property of evolutionary development based on the appearance and maturation of scientific thought and reason. In order to ensure that the main elements of Vernadsky's understanding are not obscured, it would seem important to distinguish between the noosphere and sustainable development concepts. Whereas the noosphere represents an evolutionary stage of the biosphere's development through time within which humankind plays a fundamental geological role, sustainable development is more often than not employed as a managerial concept which is being used to guide the actions of human society in order to achieve a state of 'balance' in relation to the wider environment. In this sense, and maintaining a Vernadskian perspective, it can be interpreted as a conceptually weak response to nature–society conflict *within* the context of the emerging 'sphere of reason' or noosphere.

The ideas of Vernadsky, and indeed those of Le Roy and Pierre Teilhard de Chardin, are characterised by a belief in the considerable potential of humankind to transform the surrounding environment at a geological scale. Writing in the first half of the twentieth century, there is no explicit attempt on the part of Vernadsky to associate this transforming potential with the emergence of environmental problems *per se*. Nevertheless, the evolutionary framework of Vernadsky's biosphere–noosphere system acknowledges the ambiguous nature of human action and thus would appear to raise the possibility of adverse outcomes. At the same time, Vernadsky's later work was generally optimistic in its conviction that humankind would respond effectively to the potentials opened up by the formation of the noosphere. Vernadsky's approach to humankind's growing agency vis-à-vis the surrounding environment contrasts with some contemporary 'ecological' interpretations of human–nature interaction. Here the emphasis is typically on trying to reduce the impact of humankind on the surrounding environment with metaphors such as 'treading lightly' inclined to prevail. Furthermore, Vernadsky's conceptualisation of humankind as a defining and principal component of the biosphere will find little sympathy among those who hold a more egalitarian view of the living world and humankind's place within it.

Nevertheless, Vernadsky's ideas would appear to have contemporary relevance above and beyond the specifics of his biogeochemical work or indeed the viability of his noosphere concept. In particular, his conceptual framework concerning the biosphere–noosphere transformation encourages an acceptance of humankind's growing environmental influence and geological role and shifts attention to the nature of this influence. This requires us to move beyond the important but necessarily limited discussions concerned with reducing human impact on ecological systems and engage more purposively with the task of understanding the dynamic relationship between society and nature. In addition, the scope of Vernadsky's conceptualisation suggests that such understanding should be accompanied by the utilisation of our reflective capabilities in order that we contemplate the moral basis of our activities. The biosphere–noosphere framework also provides a means by which to challenge the notion of sustainable development and suggests that this concept is, at an abstract level, often vague and inconclusive. Indeed, the uncertainty surrounding the long-term consequences of activities grounded in the rhetoric of sustainable development would

seem to indicate the need to engage critically with the cumulative impact of those technical and policy-oriented activities driven by the central tenets of the concept. The discipline of Geography, with its constituent human and physical elements, has much to offer in this respect. In particular, it has the potential to provide a basis from which to develop a broader conceptual framework within which to synthesize, focus and critique the multiple and often uncoordinated activities responding to the general call for 'balance' in the relationship between society and nature.

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¹ It has been suggested that the reference to the noosphere in the 1996 decree 'Concerning the concept of Russia's transition to sustainable development' may be due to the influence of one or two prominent policy advisors in the Russian administration (informal discussion with Oleg Yanitsky, Moscow, September 2002).

² The decree refers to the noosphere as a '*sfera razuma*' or 'sphere of reason'. Vernadsky also employs the term 'realm of reason' (*tsarstvo razuma*) in his work (e.g., [Vernadsky, 2002, p. 380](#)). In previous publications, the authors have referred to the noosphere as a 'sphere of wisdom' ([Oldfield, 2001](#) and [Oldfield and Shaw, 2002](#)). However, in the light of Vernadsky's emphasis on the importance of scientific thought it is felt that 'sphere of reason' is a more accurate English translation.

³ It should be noted that as of June 2003, this State Strategy was still to be endorsed by parliament despite a number of revisions.

⁴ The authors would like to thank an anonymous referee for this insight.

⁵ There is some confusion in Vernadsky's writings over his precise understanding of the biosphere–noosphere transformation. The English version of Vernadsky's paper 'Neskol'ko slov o noosfere' [A few words about the noosphere] which was published in the journal 'American Scientist' and titled 'The biosphere and noosphere' indicates that 'the noosphere is the last of many stages in the evolution of the biosphere in geological history' (1945, p. 10). However, it would seem likely that the translation should be 'latest' rather than 'last' since the latter translation would appear to deny the possibility of future evolutionary change. At the same time, the notion of a 'last stage' may reflect Vernadsky's particular understanding of evolutionary change whereby he envisaged the essence of the noospheric evolution (i.e., based on the biogeochemical energy associated with humankind's mental development) as a *qualitative* pinnacle of evolutionary development while simultaneously not denying further evolutionary change *within the context* of the noosphere framework. In other words, it can be argued that he did not envisage any additional fundamental qualitative shifts in the *nature* of living matter vis-à-vis its role as a geological force. However, in spite of this possible explanation, the authors prefer the reference to a 'latest stage' and this interpretation is maintained throughout the text.

⁶ All three of these scientists were leading figures in their respective fields: D.I. Mendeleev and A.M.

Butlerov in Chemistry and V.V. Dokuchaev in Mineralogy and Pedology.

⁷ Somewhat similar though possibly broader concepts, employing the notion of the 'geographical envelope', had been developed by other 19th-scholars, including the Russian geographer P.P. Semenov Tyan-Shanskii, the German geographer F. von Richthofen, and various geologists.

⁸ First published in Russian in 1926 and in French in 1929. The first complete English-language edition was not published until 1998 by Copernicus (see [Vernadsky, 1998](#)).

⁹ Furthermore, [Grinevald \(1996\)](#) provides an overview of the development of the biosphere idea more generally.

¹⁰ [Smil \(2002, p. 9\)](#) points out that Vernadsky's belief in the purposeful evolution of living matter '... sets him directly against the modern worshippers of blind randomness and selfish genes'.

¹¹ Much has been made of the fact that Vernadsky intended to produce a major piece of work towards the end of his life which sought to bring together his ideas and insight concerning geochemistry, biogeochemistry etc. At the same time, [Kuznetsov \(1974\)](#) indicates a competing intention concerned with analysing the relationship between science and philosophy. While Vernadsky was unable to realise this synthesis before he died, elements of his work do exist. The book '*Chemical Structure of the Earth's Biosphere and its Environs*' ([Vernadsky, 2001a](#)) represents an important part of this work. In addition, [Kuznetsov \(1974, p. 129\)](#) suggests that Vernadsky's work '*Scientific Thought as a Planetary Phenomenon*' should also be seen in this light.

¹² See [Lapenis \(2002, pp. 384–385\)](#) for a further discussion of Vernadsky's first and second principles of biogeochemistry. Lapenis also notes that this particular interpretation of the second principle (dated to 1940) was in fact another formulation of his original second principle first outlined in 1931. For the problem of establishing 'historical' laws, see K.R. Popper, 1957. *The Poverty of Historicism*, Routledge and Kegan Paul, London.

¹³ In contrast, it would appear that Le Roy's ideas concerning the noosphere have received limited critical engagement in the English language literature with only short tracts of his work being translated into English ([Samson, 1999, p. 60](#)).

¹⁴ Note that this refers to a shortened version of the document concerning a 'Scientific Basis for the Strategy of Sustainable Development in the Russian Federation'. The original, full version was published under the aegis of the State Duma commission for the problem of sustainable development. At the same time, there would appear to be no mention of the noosphere concept in Russia's National Assessment of Russia's Progress Towards Sustainable Development produced under the direction of the Ministry for Economic Development and Trade ([MEDT, 2002](#)).

¹⁵ The authors would like to thank Professor Vaclav Smil for drawing their attention to these two points (personal communication, October 2003).