ORIGINAL ARTICLE

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A. A network of over 100 Global Stratotype Sections and Points (GSSPs) is being established by the International Commission on Stratigraphy, a Commission of the International Union of Geological Sciences. This network of sites, about 60% of which are already ratified, relates to all the stage, system and series boundaries of the geological column and thus provides the fundamental basis for the geological timescale and the history of planet Earth. Given the importance of these sites and the work that has been ongoing by the international geological community since 1977 to select and ratify the sites, their long-term conservation is essential, yet in most cases, there is no legislative protection for them and no international recognition, beyond the geological community, of their importance. The two existing international conservation networks used to protect geological sites/areas (World Heritage Sites and Global Geoparks) are both unsuitable for the conservation of the GSSP network, and instead a case is made in this paper that UNESCO, in collaboration with other organisations, should establish a third internationally recognised geoconservation network for the com(o)(y)4018.9(ytegy)-25649en wibnternatrn/F21Tf(i)F11Tf(2(t3450-248(GSSPs)Tj0185340.199)-2489)1Tj[v0(Sciences' (IUGS) project to establish a Global Geosites network means that there are currently only two international site/area networks that recognise geoheritage values and encourage their geoconservation—World Heritage Sites and Global Geoparks.

World Heritage Sites are recognised under the World Heritage Convention, which is concerned with "protecting the world's cultural and natural heritage". The Convention was adopted by the General Conference of UNESCO in

1 Summary of the GSSP table (from Subcommission for Stratigraphic Information)

1 (continued)

		Kungurian	275.6+/-0.7	Awaited		
		Artinskian	284.4+/-0.7	Awaited		
		Sakmarian	294.6+/-0.8	Awaited		
Permian	**Cisuralian**	**Asselian**	**299+/-0.8**	**Aidaralash Creek, Kazakhstan**	**Ratified 1996**	**Episodes 21/1**
	Upper Pennsylvanian	Gzhelian	303.4+/-0.9	Awaited		
		Kasimovian	307.2+/-1	Awaited		
	Middle Pennsylvanian	Moscovian	311.7+/-1.1	Awaited		
	Lower Pennsylvanian	Bashkirian	318.1+/-1.3	Arrow Canyon, Nevada, USA	Ratified 1996	Episodes 22/4
	Upper Mississippian	Serpukhovian	328.3+/-1.6	Awaited		
	Middle Mississippian	Visean	345.3+/-2.1	Pengchong, China	Ratified 2008	
Carboniferous	**Lower Mississippian**	**Tournaisian**	**359.2+/-2.5**	**La Serre, France**	**Ratified 1990**	**Episodes 14/4**
		Farmennian	374.5+/-2.6	Coumiac Quarry, France	Ratified 1993	Episodes 16/4
	Upper	Frasnian	385.3+/-2.6	Col du Puech de la Suque, France	Ratified 1986	Episodes 10/2
		Givetian	391.8+/-2.7	Jebel Mech Irdane, Morocco	Ratified 1994	Episodes 18/3
	Middle	Eifelian	397.5+/-2.7	Wetteldorf, Germany	Ratified 1985	Episodes 8/2
		Emsian	407+/-2.8	Zinzil'ban Gorge, Uzbekistan	Ratified 1995	Episodes 20/4
		Pragian	411.2+/-2.8	Velká Chuchle, Czech Republic	Ratified 1989	Episodes 12/2
Devonian	**Lower**	**Lochkovian**	**416+/-2.8**	**Klonk, Czech Republic**	**Ratified 1972**	**IUGS Series A, 5**
	Pridoli		418.7+/-2.7	Reporyje, Czech Republic	Ratified 1984	Episodes 8/2
		Ludfordian	421.3+/-2.6	Ludlow, UK	Ratified 1980	Episodes 5/3
	Ludlow	Gorstian	422.9+/-2.5	Ludlow, UK	Ratified 1980	Episodes 5/3
		Homerian	426.2+/-2.4	Sheinton Brook, UK	Ratified 1980	Episodes 5/3
	Wenlock	Sheinwoodian	428.2+/-2.3	Hughley Brook, UK	Ratified 1980	Episodes 5/3
		Telychian	436+/-1.9	Cefn-cerig Road Section, UK	Ratified 1984	Episodes 8/2
		Aeronian	439+/-1.8	Trefawr Track Section, UK	Ratified 1984	Episodes 8/2
Silurian	**Llandovery**	**Rhuddanian**	**443.7+/-1.5**	**Dobb's Linn, UK**	**Ratified 1984**	**Episodes 8/2**
		Hirnantian	445.6+/-1.5	Wangjiawan North Section, China	Ratified 2006	Episodes 29/3
		Katian	455.8+/-1.6	Black Knob Ridge, Oklahoma, USA	Ratified 2006	Episodes 30/4
	Upper	Sandbian	460.9+/-1.6	Sularp Brook, Sweden	Ratified 2002	Episodes 23/2
		Darriwilian	468.1+/-1.6	Huangnitang Section, China	Ratified 1987	Episodes 20/3
	Middle	Dapingian	471.8+/-1.6	Huanghuachang Section, China	Ratified 2007	Episodes 28/2; 32/2
		Floian	478.6+/-1.7	Diabasbrottet, Sweden	Ratified 2002	Episodes 27/4
Ordovician	**Lower**	**Tremadocian**	**488.3+/-1.7**	**Green Point, Newf'land, Canada**	**Ratified 2000**	**Episodes 24/1**
		10	492	Awaited		
		9	496	Awaited		
	Furongian	Paibian	499+/-2	Wuling Mts, China	Ratified 2003	Lethaia 37
		Guzhangian	503	Louyixi, China	Ratified 2008	Episodes 32/1
		Drmian	506.5	Drum Mts, Utah, USA	Ratified 2006	Episodes 30/2
	3	5	510	Awaited		
		4	517	Awaited		
	2	3	521	Awaited		
		2	528	Awaited		
Cambrian	**Terreneuvian**	**Fortunian**	**542+/-1**	**Fortune Head, Newfoundland, Canada**	**Ratified 1992**	**Episodes 17/1 & 2**
Ediacaran			635	Enorama Creek, Australia	Ratified 1990	Lethaia 39
Cryogenian			850	Defined chronometrically at present. GSSP to follow.	Ratified 1990	Episodes 14/2
Tonian			1000	Defined chronometrically	Ratified 1990	Episodes 14/2
Stenian			1200	Defined chronometrically	Ratified 1990	Episodes 14/2
Ectasian			1400	Defined chronometrically	Ratified 1990	Episodes 14/2
Calymmian			1600	Defined chronometrically	Ratified 1990	Episodes 14/2
Statherian			1800	Defined chronometrically	Ratified 1990	Episodes 14/2
Orosirian			2050	Defined chronometrically	Ratified 1990	Episodes 14/2
Rhyacian			2300	Defined chronometrically	Ratified 1990	Episodes 14/2
Siderian			2500	Defined chronometrically at present. GSSP to follow.	Ratified 1990	Episodes 14/2

The Global Network of National Geoparks (Global Geoparks) was established in 2004 and is a rapidly growing international network of areas recognised for their geoheritage values. The network is supported by UNESCO but is not yet a fully recognised UNESCO programme. The three aims of Global Geoparks are conservation of the geopark's geoheritage, geological education and sustainable economic development mainly through geotourism. There are currently (November 2010) 77 members of the network in 24 countries, but most are in China (24) and Europe (42).

This paper draws attention to a third important, but less well known, geoheritage site network where international

there are three candidate GSSPs (in Poland, USA and Germany) for the base of the Coniacian. The most important sites (Series boundaries in the Cenozoic, System boundaries in the Mesozoic and Palaeozoic) are highlighted in Table 1.

Clearly, these sites are of crucial importance to international stratigraphy and ought to be retained for the future and thus need to be protected from loss or damage (though not from natural processes that retain exposure of the outcrops). Whilst inclusion on the GSSP list clearly identifies the scientific importance of these sites, it does not provide any legislative protection. This has to be the responsibility of the countries or regional/local authorities in which the sites are located. Some GSSPs do have protection through national legislative programmes. For example, Dobb's Linn in Scotland, the GSSP marking the Ordovician/Silurian boundary, is a Site of Special Scientific Interest with protection through the UK's , , , , , , (2000). Similarly, the Precambrian/Cambrian boundary at Fortune Head, Newfoundland, Canada, was designated as an Ecological Reserve in 1992. Also on Newfoundland, the GSSP marking the Cambrian/Ordovician boundary (Cooper et al. 2001) at Green Point (Fig. 1) lies within Gros Morne National Park and is therefore protected by the Parks Canada legislation and the Gros Morne National Park Management Plan. On the other hand, most of the GSSPs in the developing world and even several in the developed world are currently unprotected. For example, of the nine GSSPs currently ratified in Italy, only two are protected, including the Eocene/Oligocene boundary at Massignano (Ancona) located within the Regional Park of Monte Conero. All the others are not protected and some are in a poor condition. Similarly, the GSSP for the base of the Middle Jurassic Series and Aalenian Stage at Fuentelsaz, Guadalajara, Spain, has no legal protection (Carcavilla et al. 2009) other than the Spanish laws requiring permissions from the regional government before any palaeontological sampling can be carried out (Page et al. 2008).

Remane et al. (1996), in their revised guidelines for the establishment of GSSPs, recommended (p. 80) that:

> When making a formal submission to ICS, the concerned Subcommission should try to obtain guarantees from the respective authority concerning… permanent protection of the site.…ICS should attempt to finalise, within 3 years after IUGS ratification, any remaining official steps for the protection of the site with the authorities of the country in which the GSSP is located.

There are two points to be made about these statements. First, several GSSPs were ratified prior to these 1996 recommendations for geoconservation. Secondly, the reports on most GSSPs ratified after 1996 give little or no information about the geoconservation status of the sites. But as Page (2004) points out, the establishment of GSSPs is a conservation-driven activity in itself since the intention is to select key sites that will exist into the future as stratigraphic reference points. It follows from the above discussion that not enough attention has been given to the crucial need for conservation of GSSPs. But how should this be achieved?

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