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Integrating international, national and regional inventories – the reality: A case study from Devon, SW England, UK

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The UK's first national inventory of geologically and geomorphologically important sites was compiled by a national Nature Reserves Committee in the mid-1940s, prior to the establishment of the first UK national natural heritage conservation legislation in 1949, the National Parks and Access to the Countryside Act. Although no clear criteria were established at the time, expert opinion was sought from a selection of the national academic community. Within the historical County of Devon, this initial implementation of site nomination had, by 1955, resulted in the designation of 15 Sites of Special Scientific Interest (or SSSIs, as nationally protected nature conservation sites had become known) with a geological interest (unpublished Nature Conservancy report 1955). Although not explicitly defined, as in the much later GCR process (see below), these sites represent around 20 geological interest features, ranging from Cretaceous stratigraphy to Pleistocene Caves (see Table 1).

This initial site inventory was gradually added to incrementally and by 1970, 23 SSSIs had been designated with geological features in Devon – some purely geological others mixed geological and ecological interests – overall representing some 34 noted Earth Science features (Macfadyen 1970 – Table 1). It was not until 1977, however, that this somewhat haphazard selection process was critical reviewed and a rigorous, systematic approach to the establishment of a national inventory of national geoconservation sites established through the well-known national Geological Conservation Review, or GCR (NCC 1990; Wimbledon et al 1995; Ellis et al. 1996). The GCR established a framework of site selection categories, representing all key themes within UK geology, including stratigraphical, palaeontological, structural, mineralogical, igneous petrology and both 'fossil' and active geomorphological features and processes (as listed in full in NCC 1990). It is important to note that these sites were selected through 'expert opinion' and no scoring process or explicit statement of criteria was applied – the later classification of Ellis et al. (1990) in terms of '*international'*, '*exceptional'* and '*representative'* being a post-selection attempt at explaining the GCR's rationale rather an actual methodology.

Within Devon, the 'new' GCR inventory listed around 140 separate 'GCR sites', now explicitly identifying their thematic geological and geomorphological interest features. As these 'new' sites were gradually being designated as legally protected SSSIs under the then newly enacted Wildlife and Countryside Act 1981 (ultimately within around 106 single or multi-interest SSSIs within Devon –some including ecologicalfeatures), a new network of sites, selected using locally-derived criteria, was slowly emerging. Known collectively as '*Regionally Important Geological Sites*' or RIGS, these sites are typically selected by local, usually voluntary, NGO groups, using locally applicable criteria, including educational and even aesthetic. Within Devon, however, scientific themes still strongly influenced site selection, not least due to the extensive involvement of local University and retired national Geological Survey geologists in the process. Now known as County Geological Sites in Devon – to emphasise their conservation equivalence to County Wildlife Sites – RIGs, as elsewhere in the UK are generally protected through local development plan policies for nature conservation in the wider environment, rather than through explicit natural heritage legislation. They are consequently, therefore, often referred to as 'Non-Statutory' sites

Within Devon, the initial selection of RIGS produced a County-wide inventory of 60 sites, representing around 80 noted interest features (when compared with GCR categories). This survey was followed up over the following 15 years by more detailed, local authority by local authority surveys, ultimately producing a County inventory of around 232 RIGS representing around 265 listed geological features (Table 1). Within these local surveys, however, many features of national and international importance which had been 'overlooked' by the national GCR process were identified.

In addition, the development of the concept of international 'Geosites' (Wimbledon et al. 2000) has created, at least conceptually, another level of site importance, that of international. Unlike RIGS sites, however, which have some limited protection through local spatial planning systems, there is no mechanism in the UK for enhancing the protection of geoheritage sites of demonstrable international importance. The latter problem is compounded by an apparent refusal by governmental conservation agencies to even acknowledge that such sites may even exist and there has been no material progress on the recognition of geosites over the past 20 years - despite published listings of applicable networks for the UK (e.g. in Cleal et al. 2001, etc). Notably, however, this framework *has* been applied in Devon, at least in the context of identifying the County's 'key' geological features, and incorporated into the rationale and objectives of the strategic nature conservation document: *The Nature of Devon – A Biodiversity and Geodiversity Action Plan*' – also known as the Devon 'BAP' (www.devon.gov.uk/index/environment/ natural environment/biodiversity/ devon biodiversity action plan.html) . The proposed Geosites categories applicable to Devon are as follows, with the corresponding GCR network (as represented in Devon) indicated [in brackets]:

1. '*Devon (marine) carbonates, clastics (Devon -Cornwall)*' [= 'Marine Devonian']
2. '*Igneous rocks linked to the northern European Variscan fold-belt'* [= 'Igneous rocks of SW England', part]

3. '*Minerals and mineral assemblages in igneous intrusions'* [= 'Igneous rocks of SW England', part]
4. '*Sn-Cu-AS veins associated with Cornubian batholith*' ['Mineralogy of SW England', part]
5. '*Contact metamorphic assemblages'* ['Mineralogy of SW England', part]
6. '*Supergene mineralisation'* ['Mineralogy of SW England', part]
7. '*Permian-Triassic red-bed sequence (Devon coast)'* ['Permian-Triassic']
8. '*Lower Jurassic, classic marine Hettangian-Toarcian'* (West Dorset)
9. '*Sub-Albian regional unconformity (Dorset-Devon-Devon)*' ['Aptian-Albian']
10. '*Early Jurassic marine reptiles and insects (Lyme Regis and Yorkshire)*' [= 'Jurassic - Cretaceous Reptilia']
11. '*Late Pleistocene interglacial/glacial, cave/beach sediments (Saalian-Weichselian)*' [= 'Quaternary of SW England', part; 'Pleistocene Vertebrata']
12. '*Late Pleistocene Interglacial (OIS7, 5e) raised beaches (southern England, Cornwall, South Wales)*' [= 'Quaternary of SW England', part]
13. '*Granite tors of Devon/Cornwall'* [= 'Quaternary of SW England', part]
14. '*Atlantic coastal dunes'* [= 'Coastal Geomorphology of England', part]
15. '*Erosional structure/lithology-controlled coast'* [= 'Coastal Geomorphology of England', part]
16. '*Rias (west Wales and Devon/Cornwall)*' [= 'Coastal Geomorphology of England', part]
17. '*Landslides (both relic and active)*' [= 'Mass movement']

An additional Geosites category was also proposed in Section E of the Devon BAP ('*Variscan structures of Devon and Cornwall*') but is not yet formally adopted. Nevertheless, although potentially of great value for prioritising conservation initiatives, this use of Geosite categories still has no defined legal status in the UK and the Devon 'BAP' may well be unique in the UK as it refers to the process.

Although Devon also has several UNESCO-supported designations related to its geological heritage, including a Global Geopark in Torbay (www.englishrivierageopark.org.uk/) and part of the Dorset and East Devon World Heritage Site with its remarkable exposures of a Triassic to Cretaceous stratigraphical succession (www.jurassiccoast.org/), neither of these designations is linked to a systematic geoheritage inventory (and only a very slightly enhanced protection is offered by the second designation alone). A second World Heritage

site which overlaps the County boundary is the Cornish Mining Landscapes site (www.cornish-mining.org.uk/), but despite including a large number of exceptional geoheritage sites, it is currently designated solely for cultural values.

The Devon situation is quite typical of the UK as a whole and without an assessment of the relationship between the regional RIGS network, the national GCR network and international designations and listings such as Geosites and GSSPs, there is no clear picture of the relative 'importance' of the UK's 1000s of 'designated' geoheritage sites - and there is not now even a clear national inventory. With the complete closure of the GCR unit in the early 2000s and the UK's continuing devolution into component 'nations', each with essentially independent national conservation agencies, this scenario is unlikely to improve.

The problems of the interrelationship between the various applicable geoheritage 'inventories', both statutory and non-statutory, is a national problem in the UK, but fundamental to the most effective, targeting of the limited resources now available for conservation – it would be very nice to safeguard all our *regional* geoheritage sites, but safeguarding those of *international* and *national* importance should be considered imperative. But how can such decisions be meaningfully made when there is no up-to-date national inventory to guide governmental authorities and agencies? As there is currently no political will amongst national agencies in the UK to resolve this problem, the only potential solutions that remain are likely to be driven through the European Community - for instance through a directive to ensure that member states have the appropriate inventories in place to inform the safeguard of the community's geological heritage as a whole.

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Thematic interests (classified within post-1977 GCR networks)	**National protected sites**			**Regional selected sites**		**Total thematic interest features** (= columns 4+6)
	1955 SSSIs	**1970 SSSIs**	**2009 GCR**	**1995 CWS**	**2010 CWS**	
Devonian stratigraphy and palaeontology*	4	4	**35**	16	**75**	**110**
Silurian - Devonian Chordata			**1**			**1**
Lower Carboniferous ('Dinantian')			**7**	3	**7**	**14**
Upper Carboniferous ('Namurian')			**2**	1	**5**	**7**
Upper Carboniferous ('Westphalian')			**2**	6	**8**	**10**
Palaeozoic palaeobotany			**2**	2	**1**	**3**
Variscan structures		1	**13**	10	**24**	**37**
Igneous rocks (of SW England)*	1	1	**15**	9	**38**	**53**
Mineralogy of SW England*	1	3	**9**	3	**29**	**38**
Permian-Triassic (non marine)*	1	2	**8**	15	**30**	**38**
Permian-Triassic Reptilia			**2**			**2**
Triassic (Rhaetian)		2	**2**			**2**
Lower Jurassic (Hettangian-Pliensbachian)*			**1**		**1**	**2**
Jurassic - Cretaceous Reptilia*			**1**			**2**
Mesozoic - Tertiary Fish/Amphibia			**1**			**2**
Lower Cretaceous (Aptian-Albian)*	2	3	**2**	3	**7**	**9**
Upper Cretaceous	5	5	**3**		**2**	**5**
Palaeogene- Neogene	1		**1**		**5**	**6**
Pleistocene/ Quaternary (of SW England)*	2		**16**	7	**16**	**32**
Pleistocene vertebrata*			**2**		**1**	**3**
Caves and karst*	1	5	**4**		**5**	**9**
Mass movement*	1	1	**1**			**1**
Fluvial Geomorphology of England			**5**	4 (incl. landscape view points)	**7** (incl. landscape view points)	**12**
Coastal Geomorphology of England*			**5**		**3**	**8**
TOTALS (protected	**20**	**34**	**140**	**80**	**264**	**406** protected

features / conservation sites)	(within 15 SSSIs)	**(**within 23 SSSIs)	(within 106 SSSIs)	(within 60 CGS)	(within 232 CGS)	geological features

Table 1: The development of the Devon geoconservation inventory: SSSI = nationally protected Sites of Special Scientific Interest; GCR = nationally selected Geological Conservation Review sites (protected as components of SSSIs); CGS = locally designated County Geological Sites. GCR categories marked with an asterix (*) correspond to UK Geosites frameworks proposed by Cleal et al. (2001), therefore confirming an international significance to a range of the sites included within the network