

research, although they probably never used those words. Not only is geology inherently multidisciplinary in its very nature, because of its dependence upon physics, chemistry, and biology and its relations with astronomy and meteorology, but those leaders in our science a

century and more ago were men with a definitely philosophical bent. In a sense, the cycle of the history of science is even now coming full circle. Enlightened and inspired by such contacts with other scientists as those provided by the AAAS, geologists today and tomorrow may

make contributions to human welfare far more valuable than even the discovery of new oil fields or additional bodies of uranium ore.

Reference

1. H. L. Fairchild, *Science* 59, 365 (1924).

Transliteration of Russian

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On the last pages of the 1955, 1956, and 1957 index numbers of the *Mathematical Reviews* is given a table of seven different systems of transliteration of Russian, including the systems used by the U.S. Library of Congress, by *Science Abstracts*, by *American Slavic and East European Review*, and by *Mathematical Reviews* itself. No comment is offered and no question is asked about why there should be so many systems or why the *Mathematical Reviews* needed to set up one of its own. Moreover, the table is of course not—and admittedly not intended to be—complete. The British Museum, the Slavonic Division of the New York Public Library, the Library of the New York Academy of Medicine, the Institute for the Study of the U.S.S.R., *Biological Abstracts*, *Chemical Abstracts*, and, above all, the U.S. Government Printing Office *Style Manual* all use systems that are in some respects different from each other and different from each of the systems in the table of the *Mathematical Reviews*. Indeed, essentially the widest difference in transliteration is that between (i) the system used by the Library of Congress and (ii) the one recommended by the Government Printing Office *Style Manual*. The former, for instance, resorts to no less than 11 diacritically marked letters while the latter is content with only one such marking—the dieresis over *e*, which, too, the Government Printing Office manual suggests, may be omitted whenever it is omitted in Russian (as it often is).

Clearly, use of this multiplicity of systems and the resulting waste and confu-

sion need not continue. The multiplicity persists indeed only in scientific periodicals and in library catalogs and publications. The daily press, popular magazines, and by far most current translations of books seem to evolve gradually a more or less uniform system. One does not find, for instance, in these latter media the *Mathematical Reviews'* *Hruščev* and *Čerenkov* or the Library of Congress' *KHrushchev* and *CHerenkov* (with ligatures over *KH*, *CH*, and *shch*) for familiar *Khrushchev* and *Cherenkov*, to name only two common examples and two science-and-library systems of transliteration. Moreover, it should in general be noted that transliteration divergences exist only with respect to 13 of the 33 letters in the modern Russian alphabet: six consonants, six vowels, and a semi-vowel. *Bulganin*, *Pasternak*, and even *Pavlov* present no problem (Pawlow and Pavloff are quite obsolescent by now). But let me detail briefly the argument and the suggestion for uniformity.

Consonants

Use of ligatures, multiple capitals, inverted circumflexes, and the letters *H*, *J*, and *TZ*. The Library of Congress system uses ligatures over *zh*, *kh*, *ts*, *ch*, *sh*, and *shch* in transliterating Russian *ж*, *х*, *ц*, *ч*, *ш*, and *щ* (it also uses ligatures for some vowels, but this will be taken up later) and in addition capitalizes the two—in one case, four—letters when they occur initially. The rationale of the practice is presumably that of facilitating

library cataloging and filing by indicating that the English combinations of letters correspond to single Russian letters. But, plainly, this limited and doubtful advantage must be pitted against the fact that ligatures and extra capitals are both expensive and unesthetic, add nothing from the standpoint of approximate pronunciation, and, indeed, have hardly ever been maintained consistently. The Library of Congress itself does not use ligatures in its *Monthly List of Russian Accessions*, nor does the *Current List of Medical Literature* published by the National Library of Medicine. Why, then, not give up the cumbersome practice altogether and avoid confusion and expense?

Several systems, notably the *American Slavic and East European Review* and the *Mathematical Reviews*, use *ž*, *č*, *š*, and *šč*, instead of *zh*, *ch*, *sh*, and *shch*, in transliterating the corresponding Russian letters. But, again, there is the problem of expense and esthetic appearance, to which should be added the even more important consideration of the average reader's unfamiliarity with the meaning of these marks and consequent gross mispronunciation. A good number of my colleagues—even the literary ones—pronounce the name of the famous Czech dramatist Čapek as "Kapek" and not, as they should, "Chapek." Besides, in general, diacritical marks are alien to both Russian and English, the former utilizing them only in *й* and occasionally in *ё*, and the latter resorting to them even more rarely.

Finally, there is the use of *h* instead of *kh* for Russian *х* by the *Mathematical Reviews*, of *j* instead of *zh* for Russian *ж* by the Library of the New York Academy of Medicine, and of *tz* instead of *ts* for Russian *ц* by the Slavonic Division of the New York Public Library. And here the inadequacies are even more evident. English *h* does not have the sound of Russian *х*; the French, and not the English, *j* is equivalent to Russian *ж*

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(English *z* in *azure*); while *tz* is an impossible combination phonetically, a voiceless *t* with a voiced *z* (our own *quartz* notwithstanding). True, *kh* and *zh* do not equal the respective sounds of Russian *х* and *ж*, either; yet, they at least have the advantages of indicating the existence of a separate sound and of long-standing usage (think of Zhukov, Kharkov, and so on).

In fine, it is suggested that the following transliterations be consistently used for the now multiply transliterated six Russian consonants *ж, х, ц, ч, ш*, and *щ*: *ж, zh; х, kh; ц, ts; ч, ch; ш, sh; and щ, shch*.

Vowels

Letters Ю, Я, and Ы. The letters *ю* and *я* are, respectively, pronounced almost exactly as *yu* in *yule* and *ya* in *yard* and should be so transliterated. The *iu* and *ia* of the Library of Congress are, despite the ligatures, likely to be disyllabized in accordance with English usage, while the *ju* and *ja* of the *American Slavic and East European Review* are sure to be mispronounced by readers unfamiliar with, or unmindful of, phonetic designations.

English *y* might well be used to transliterate also Russian vowel *ы* which roughly sounds as *y* in *rhythm* (only roughly, though). Little confusion will result from this use of *y* as both a vowel and a semivowel: Russian *ы* occurs typically only between consonants and at the end of words, never initially or after a vowel, besides the fact that *y* serves a double, vowel-semivowel function also in English and in French. Hence, the *ȳ* of *Science Abstracts* and the *ı* of *Applied Mechanics Review* are unneeded and cumbersome (in the very rare cases of *ы* occurring before a vowel, the Russian "hard" mark, later transliterated as a double apostrophe, used in Russian as a separation mark, might be utilized to indicate that two vowels are involved).

Е, Ѕ, and Ё. At the beginning of words and after vowels and the "soft" and "hard" marks, the *е* is clearly pronounced as *ye* in English *yes* and should be transliterated as *ye* and not merely *e*. *Yesenin, Andreyev, polnoye sobraniye, zdorov'ye*, and *s'yezd* will be pronounced fairly correctly by any English reader, while *Esenin, Andreev, polnoe sobranie, zdorov'e*, and *s'ezd* (infra for the transliteration of the "marks") will not. On the other hand, while Russian *е*

denotes palatalization also of preceding consonants, this palatalization is varying and often very slight, so that transliteration of Russian *е* after consonants by English *e* alone is quite adequate. Hence, *Lenin, Turgenev, Cherenkov*, and *Belorussia* rather than *Byelorussia*. *Soviet*, however, might be left as an exception—the only exception—because of its inveterateness, though in adjective form *Sovetskoye, Sovetskaya*, and *Sovetsky (Sovetskii)* may be preferred.

Russian *э* invariably approximates English *e* in *else* and should be transliterated by plain *e* rather than by *é, è, or ê*, as it is in a number of different systems. The use of *ye* for Russian *е* at the beginning of words and syllables obviates any significant confusion between the rendering of *э* and *е*.

The *ё* in Russian is pronounced as *yo* except after letters *ж* and *ш* where it is sounded as *o*, and should thus be transliterated as *yo* or *o*. Leaving it as *è* perpetuates a gross mispronunciation (note that the Russian ballet *Берёзка* is rendered correctly in the daily press as *Beryozka* and not *Berëzka*).

Semivowel

After *а, о*, and Russian *у* (English *u*), *й* is clearly pronounced like the *y* in the English word *boy*, while the combination *ей* sounds like the *ey* in the English word *they*. English *y*, and not *ı*, is thus the most appropriate letter for transliterating *й*.

However, when *й* occurs after *ы* or *и* (English *i* in *machine*), it is almost silent, which, added to the fact that *yy* and *iy* are awkward combinations, suggests that the *й* be omitted here altogether. *Белый* may thus be transliter-

ated as *bely* and *синий* as *sini*. Note the rendition in the daily press of *Новый Мир*—the Soviet literary magazine in which Pasternak was recently attacked—as *Novy Mir* and not as *Novyi, Novyy, Novii* and *Novyj Mir*, the way the systems of the Library of Congress, the Government Printing Office, *Applied Mechanics Abstracts*, and *American Slavic and East European Review* would respectively have it.

Again, in the combinations *-ский* and *-кий*, notably in Russian surnames, the suggested transliteration is *-sky* and *-ky* and not *-ski* and *-ki* both because *y* and not *i* is our typical final letter and because *-sky* and *-ky* help distinguishing Russian surnames from Polish ones which end in *-ski* and *-ki*.

Other Letters

"Soft" and "hard" marks **Ь** and **Ъ**; Genitive **-ГО**. The "soft" mark serves in Russian as an indicator of a preceding palatalized consonant as well as a separator of syllables; the "hard" mark functions only as a separator. For some time, the "soft" mark has been transliterated as an apostrophe, by almost all systems, but there has been no consistency with respect to the "hard" mark. My suggestion is that the Library of Congress' rendition of the "hard" mark as a double apostrophe or quotation mark be accepted. *Science Abstracts'* practice of a downward single quote for the "hard" mark and of an apostrophe for the "soft" mark is difficult for typescripts where the two are not differentiated.

The ending **-го** (English *go*) in the genitive case is pronounced in Russian as *vo* and should be so transliterated.

Table 1. Complete and uniform transliteration of Russian into English.

Russian	English	Russian	English	Russian	English
а	a	к	k	х	kh
б	b	л	l	ц	ts
в	v	м	m	ч	ch
г	g; Genitive -го, -vo	н	n	ш	sh
д	d	о	o	щ	shch
е	ye at beginning of syllables; e elsewhere	п	p	ъ	"
ё	yo; o after ж and ш	р	r	ы	y
ж	zh	с	s	ь	'
з	z	т	t	э	e
и	i	у	u	ю	yu
й	y; omit after и and ы; -ский = -sky, -кий = -ky	ф	f	я	ya

Summary

The objective of any system of transliteration is obviously to convey to the reader as closely as possible the phonetic value of the transliterated material. Barring phonetic transcriptions, this objective is doubtless best accomplished when (i) minimum use is made of extra marks and extra letter combinations that of necessity are arbitrary, unclear, and confusing to many readers, and when, of course (ii), there is only one uniform system and not a variety of varying ones. A detailed analysis reveals that present-day practices of transliterating Russian into English by no means conform to these desiderata, but that they could readily be made to do so. With only two extra letter combinations, *zh* for *ж* and *kh* for *х*, and a single and a double apostrophe for the "soft" and "hard" marks, a very close approximation of Russian phonology may be attained through a discriminating use of

English as is. A complete and uniform transliteration of Russian into English, including the noncontroversial letters, is shown in Table 1.

Note added in proof. After this article was written, I came across the transliteration system of the *Current Digest of the Soviet Press*, a system the stated rationale and objective of which are much the same as those advocated here. However, the *Digest's* system clearly gets away from "approximating Russian sounds" in transliterating (i) *я* after *и* by *a*, (ii) *ь* and *ъ* before vowels by *y*, and in (iii) omitting *ь* altogether before consonants and at the end of words. The *прия-* in *приятно* certainly differs from the *пря-* in *прятать*, as do also the *дья-* in *дьякон* from the *дя-* in *дядя*, the *объя-* in *объяснять* from the *обя-* in *обязать*, and the *поль-* in *полька* from the *пол-* in *полка*. The last pair of words, furthermore, illustrates the fact that the *Digest's* system obliterates distinctions between Russian

words of totally different meaning and etymology, a fact manifesting itself particularly often when the omission of the *ь* is at the end of words and no difference is thus obtained between the transliteration of such words as *брат* and *братъ*, *ел* and *ель*, *пыл* and *пыль*, *цел* and *цель* and many others—as well as between the transliteration of the third person present (and future) singular and the infinitive in *-ить* class verbs. Again, the *Digest's* transliteration of *ю* and *я* after *ы* by *iu* and *ia* obviously destroys the uniformity of the rendition of the two letters, whereas my suggestion that in general a double apostrophe—the transliteration of *ъ*—be inserted between transliterated *ы* and succeeding vowels not only preserves this uniformity but also provides for the case of Russian *у* (English *u*) after *ы* as in *выучить* (the *Digest's* system does not mention *у* after *ы* and is not specific about *е* after *ы*).

News of Science

House Science and Space Committee Holds Hearings to Establish the Scope of Its Responsibilities

Since the opening of Congress last January the House Committee on Science and Astronautics has been holding a series of hearings covering a wide range of governmental scientific activities. Witnesses from a number of federal agencies—for example, the National Science Foundation, the National Aeronautics and Space Administration, and the National Bureau of Standards—have appeared before the committee in recent months. Most recently, Alan T. Waterman, director of the National Science Foundation, gave testimony on the activities of his organization.

Two purposes are being accomplished, according to observers. First, the 25 members of the committee, many of them new to the House of Representatives, are becoming acquainted with the agencies, the administrators, and the scientific activities that make up their area

of legislative interest. Information derived from the testimony is being compiled into a number of reports to which the committee members can refer during future deliberations on matters affecting the various agencies. The second purpose is to define, in rough outline, the committee's jurisdictional range.

Space Committees

The House Committee, which succeeds the Select Committee on Astronautics and Space Exploration, has a counterpart in the Senate which was set up just 1 month earlier. The establishment of similar permanent committees in the two chambers of Congress at roughly the same time is a rare event in the history of the Legislature. The last such instance was in 1892, when both chambers established committees to deal with interior and insular affairs. The

chairman of the new House group, Overton Brooks (D-La.), gave up his 22-year seniority ranking as a member of the Armed Services Committee to preside over the activities of the Science and Astronautics Committee.

The new group has permanent status as a standing committee. It will benefit from the work done by its predecessor, the Select Committee, which issued a number of publications on space and had a role in formulating the legislation that established the National Aeronautics and Space Administration. There is considerable continuity with the old group, with respect to committee members and staff members. John W. McCormack (D-Mass.), for example, served as chairman of the Select Committee and is now the second ranking Democrat in the new group. Other long-term members are Joseph Martin (R-Mass.) and Walter Riehlman (R-N.Y.).

Jurisdictional Range

The primary concern of the committee during this early period of its existence is its jurisdictional range. Jurisdiction over the National Science Foundation, the Space Administration, and the National Bureau of Standards was explicitly assigned to the committee in House Resolution 580, which set it up. However, other areas of responsibility were also indicated, in less explicit language. These include "scientific and astronomical research and development generally . . . outer space . . . and science scholarships." Hearings held earlier this year on the Nike missile program repre-