MEASURABLE INDICATORS OF SUCCESSFUL GEOLOGY DEPARTMENTS

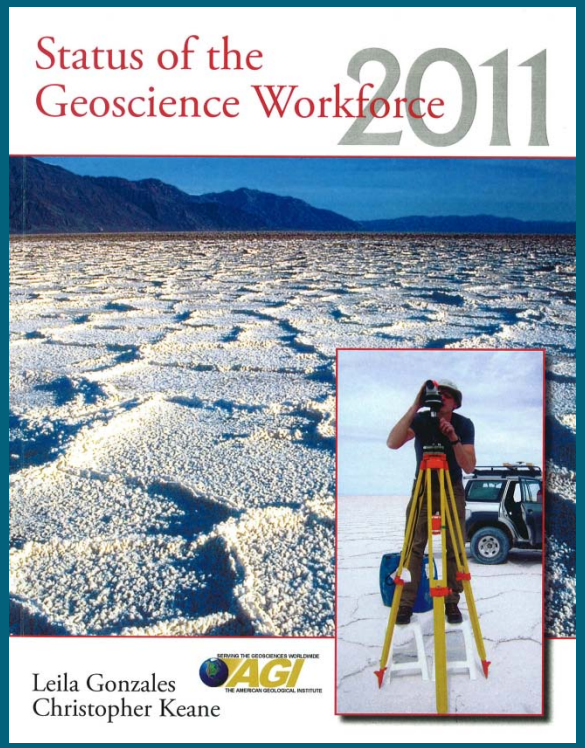
Geological Society of America Annual Meeting
Charlotte, North Carolina
November 5, 2012

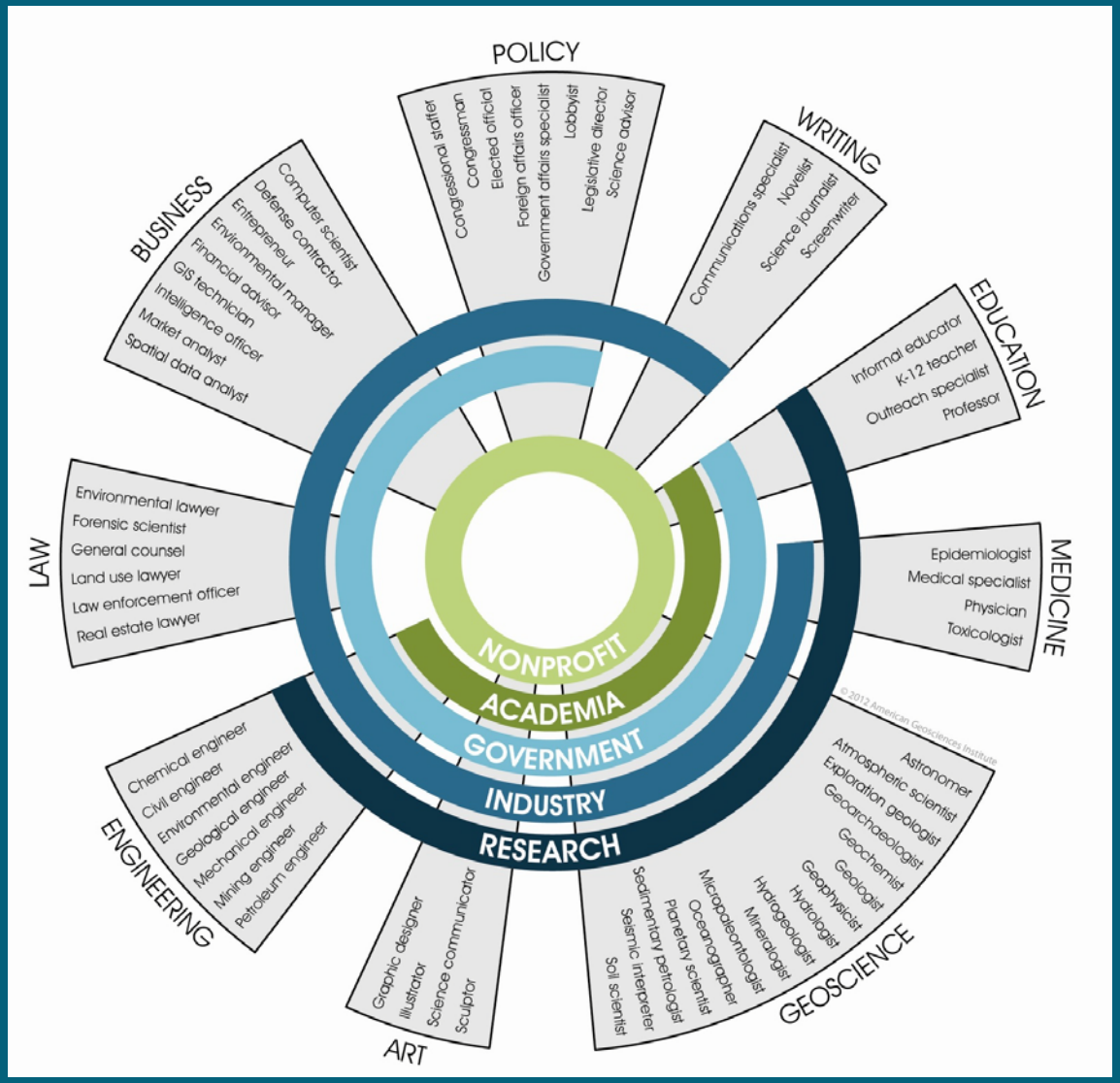
Robert W. Ridky
U.S. Geological Survey

WORKFORCE ISSUES in ENGINEERING and MEDICINE

USGS

STRONG GEOSCIENCE EMPLOYMENT OUTLOOK





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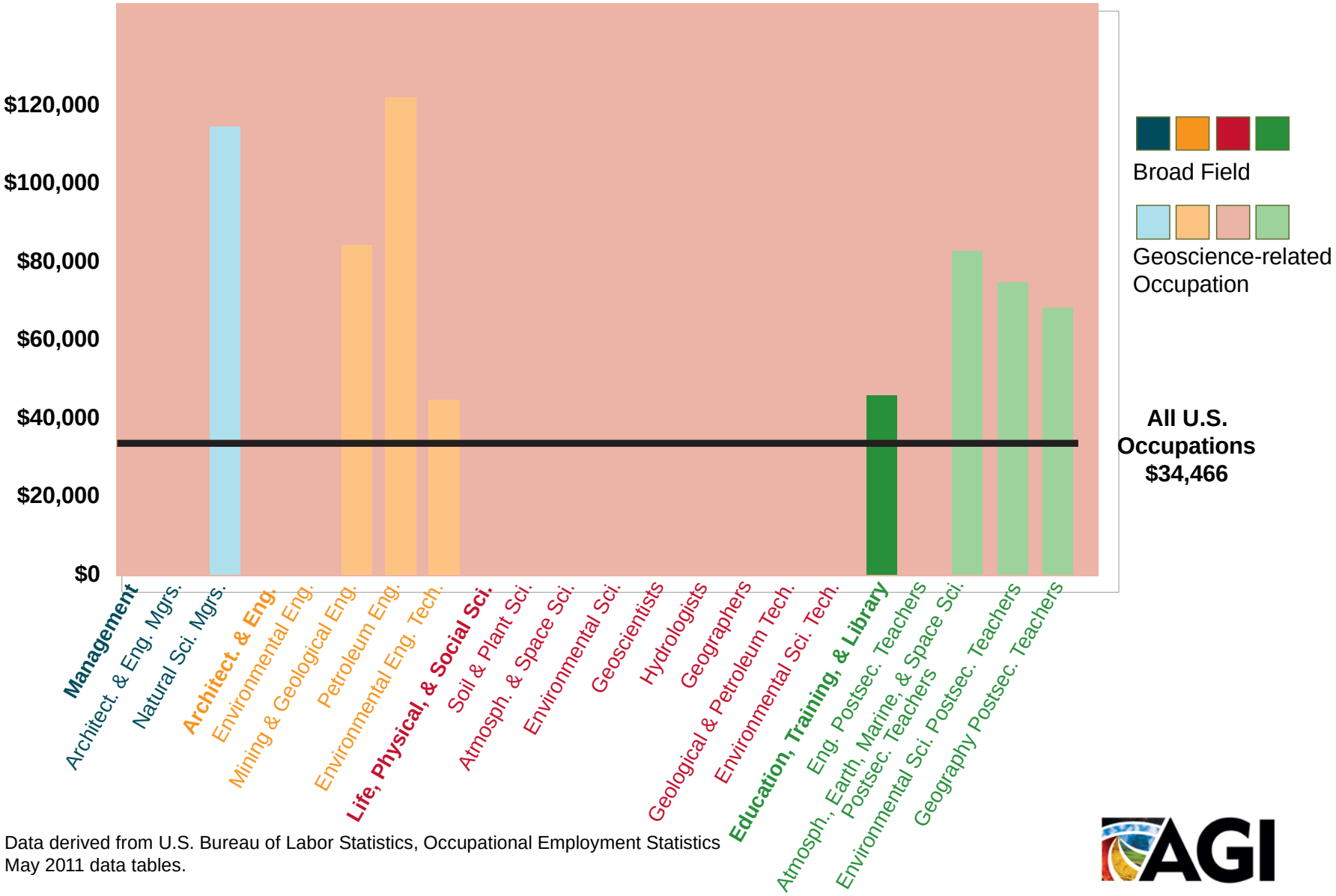
The Breakdown: Workforce Trends



Data derived from U.S. Bureau of Labor Statistics, Occupational Employment Statistics May 2011 data tables.

Table 315: **Degrees conferred in biology, micro, and zoology 1980-’81 to 2009-’10**

	Biology			Microbiology			Zoology		
year	B	M	D	B	M	D	B	M	D
80-81	31323	2598	734	2414	482	370	3873	881	613
85-86	27618	2173	574	2257	392	362	2894	618	548
90-91	29285	1956	632	1788	343	443	2641	551	516
95-96	44818	2606	768	2200	364	606	3463	677	501
00-01	42310	2582	780	2779	334	553	3045	560	380
05-06	48855	2719	776	2243	372	612	2140	384	254
09-10	58732	3156	914	2449	303	767	2147	360	243

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Source: NCES, Digest of Educational Statistics: 2011

Table 329: **Degrees conferred in chemistry, geology, and physics 1980-'81 to 2009-'10**

	Chemistry			Geoscience			Physics		
year	B	M	D	B	M	D	B	M	D
80-81	12682	1862	1649	**6332**	**1702**	**404**	3441	1294	866
85-86	10110	1712	1878	**5760**	**2036**	**395**	4180	1501	1010
90-91	8311	1637	2196	**2367**	**1336**	**600**	4236	1725	1209
95-96	10395	2214	2228	**4019**	**1288**	**555**	3679	1678	1462
00-01	9466	1952	2056	**3495**	**1220**	**472**	3418	1365	11699
05-06	10606	2044	2403	**3322**	**1476**	**505**	4541	1846	1341
09-10	12107	2122	2469	**4093**	**1446**	**613**	4982	1792	1570

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Source: NCES, Digest of Educational Statistics: 2011

Increase in total undergraduate enrollment:1980-2010

1980	**12,096,895**
1985	12,247,055
1990	13,818,637
1995	14,261,781
2000	15,312,289
2005	17,487,475
2010	**21,575,000**

Source: NCES, Digest of Educational Statistics: 2011

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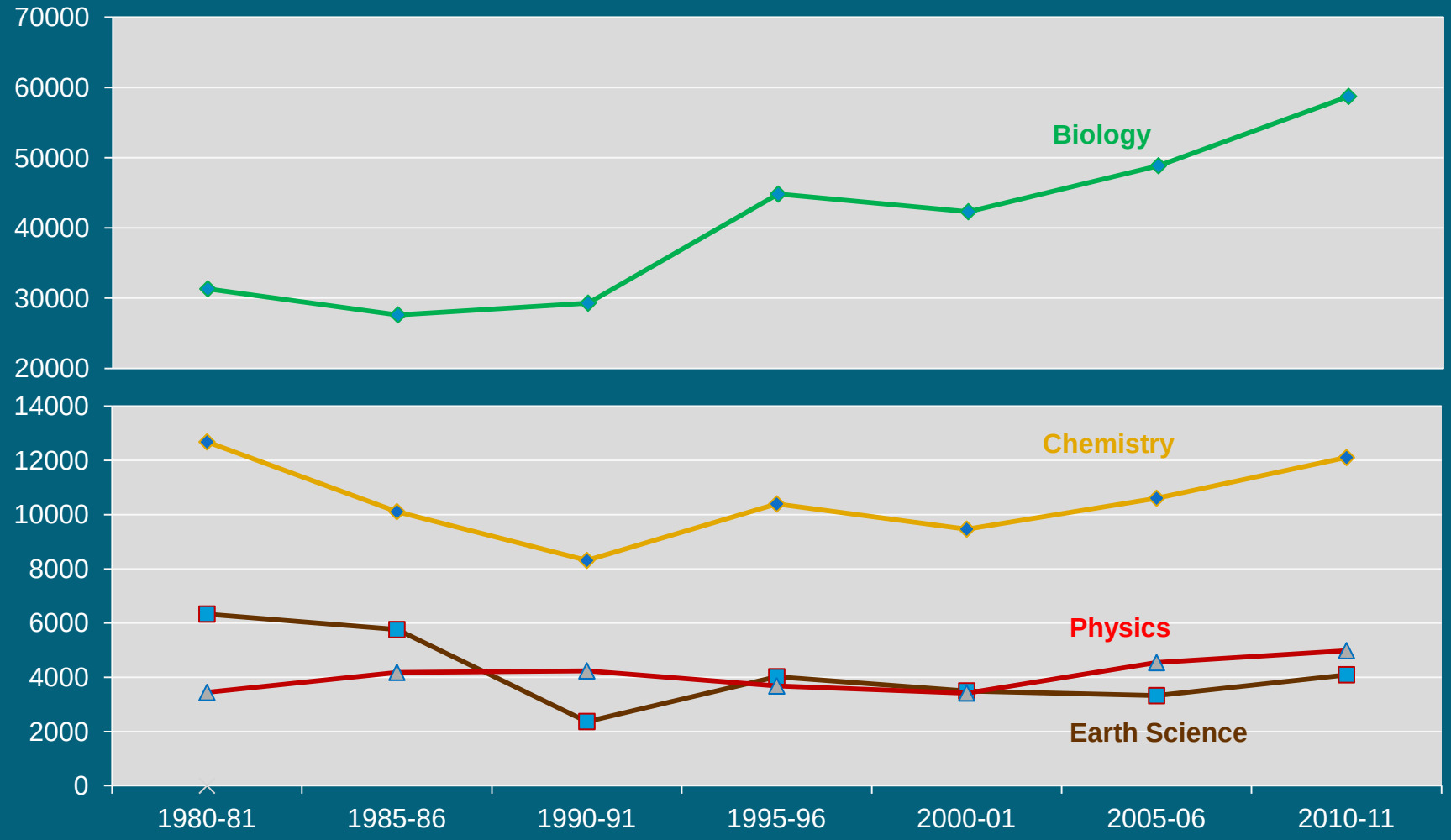
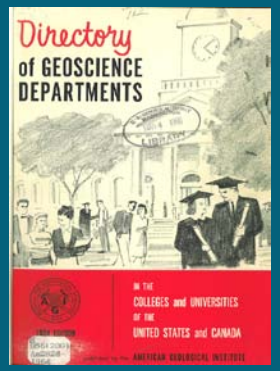
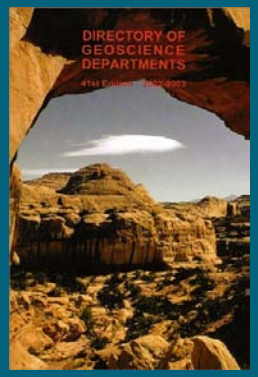
Number of Bachelor Degrees in Natural Science Courses (1980 – 2010)

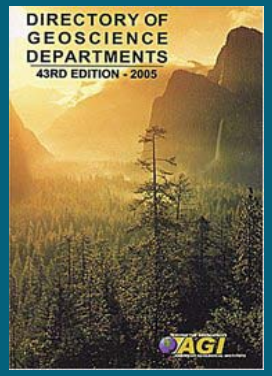


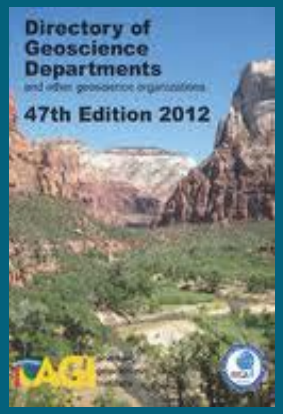
Source: NCES, Digest *of* Educational Statistics 2011, Table 161

AGI'S Directories of Geoscience Departments (spans 47 years)









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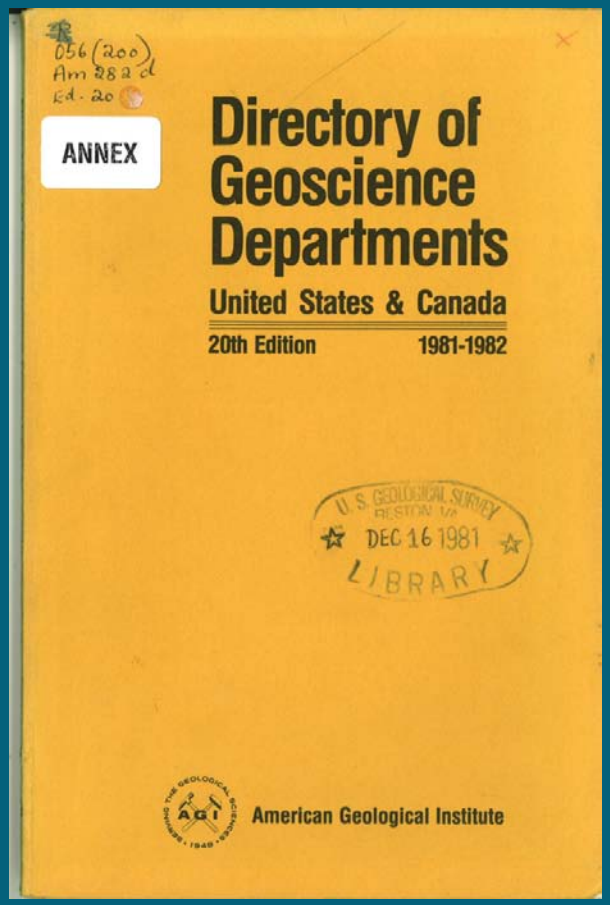
Directory of Geoscience Departments, 1981



Directory of Geoscience Departments Website, 2011

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4-Year Degree Granting Institutions

	1981	2011
Number of 4-year institutions with geo-specific departments (geology, geoscience, or earth science)	448	432
Number of tenure/tenure track faculty in geo-specific departments (professors, assoc. and assist. professors)	3432	4237

Changes in 4-Year Institutions from 1981 to 2011

Number of Institutions that have deleted "geo"- department	61
Number of Institutions that have added "geo"- department	44
Number of institutions that altered name of their "geo"- department. Of these, 80% (184) have expanded/combined with other departments	231

2-Year Degree Granting Institutions 1981 to 2011

Number of 2-year Institutions with Geo-specific Departments (Geology, Geoscience, or Earth Science)	91	175
Total number of Faculty in Geo-specific Departments (professors, associate professors, assistant professors)	147	241

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Source: AGI, *Directory of Geoscience Departments*, 1981 and 2011; NCES, IPEDS 2011

Top 10 (4yr+) Programs Expanding Discipline Base

University of Washington
1981: Geological Sciences; faculty 20 (0)
2011: Earth & Space Sciences; faculty 42 (4)

Purdue University
1981: Geosciences; faculty 25 (9)
2011: Earth & Atmos. Sciences; faculty 44 (16)

Arizona State University
1981: Geology; faculty 20 (0)
2011: School of Earth & Space Exploration; faculty 36 (13)

University of Southern California
1981: Geological Sciences; faculty 13 (1)
2011: Earth Sciences; faculty 28 (3)

University of Houston
1981: Geology; faculty 14 (1)
2011: Earth and Atmos. Sciences; faculty 29 (4)

University of Nebraska
1981: Geology; faculty: 11 (0)
2011: Geosciences; faculty: 25 (9)

Rutgers State University
1981: Geological Sciences; faculty: 9 (1)
2011: Earth and Planetary Sciences; faculty: 23 (2)

Georgia State University
1981: Geology; faculty: 3 (0)
2011: Geosciences; faculty: 16 (8)

University of Memphis
1981: Geology; faculty: 7 (1)
2011: Earth Sciences; faculty: 20 (4)

University of California, Santa Cruz
1981: Earth Sciences; faculty: 10 (0)
2011: Earth & Planetary Sciences; faculty: 22 (2)

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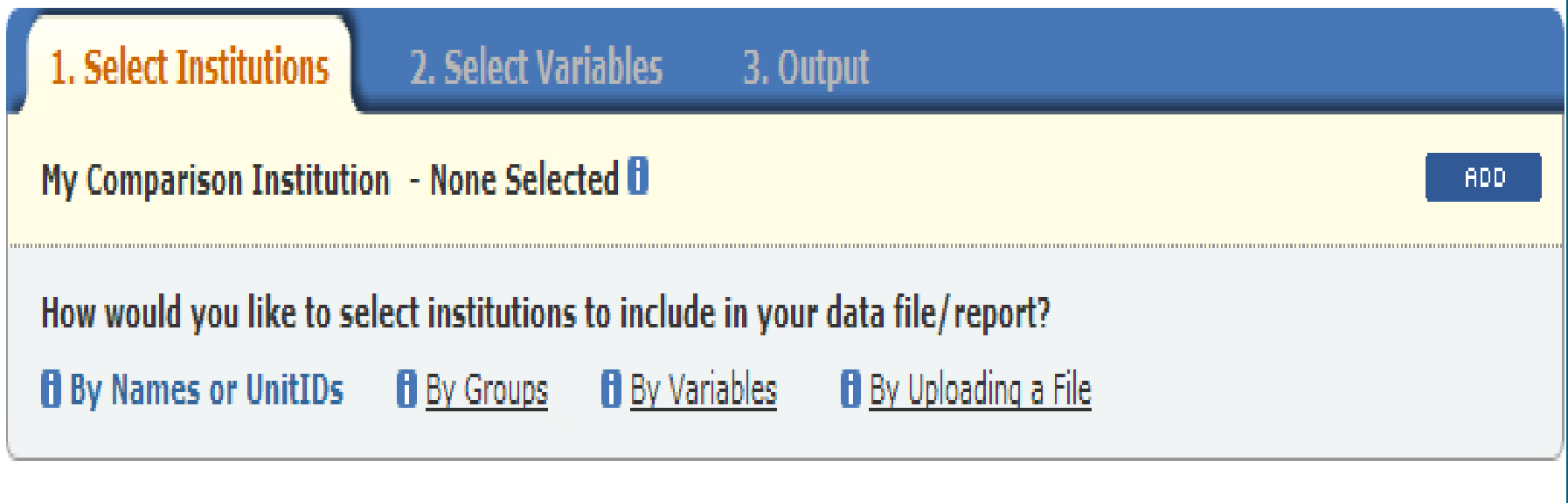
XX = “non-geo” (solid earth)

NATIONAL CENTER FOR EDUCATIONAL STATISTICS

Integrated Postsecondary Education Data System



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Geoscience Degrees Awarded Over 30 Year Interval *

	B	M	D	Total
Average Number of Degrees Awarded Annually (1980, 1984, 1985, 1986)	6,566	1,833	411	9,567
Average Number of Degrees Awarded Annually (2006, 2007, 2008, 2009, 2010)	3,622	1,412	590	5,626

*Geoscience/Earth; Paleontology; Hydrology and Water Resource Science; Geochemistry and Petrology; Oceanography, Chemical and Physical; and Geological and Earth Sciences/Geosciences, Other. Science Degrees includes the following majors: Geology/Earth Science, General; Geochemistry; Geophysics and Seismology

Source: NCES, Digest of Educational Statistics: 2011; Table 329.

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Bachelor Degrees/Tenure or Tenure Track Faculty (all 4 year and above institutions)

1980's = 1.91 **2000's = 0.85**

	Bachelors/faculty	# of institutions
1980s	2.85	248
2000s	1.32	253

Bachelor Degree Institutions (only)

	Bachelors/ faculty	Masters/ faculty	# of institutions
1980s	2.27	0.69	103
2000s	0.89	0.62	79

Bachelor & Master Degree Institutions

	Bachelors/ faculty	Masters/ faculty	Doctorates / faculty	# of institutions
1980s	1.65	0.86	1.43	105
2000s	0.70	0.44	0.27	125

Doctoral Degree Institutions

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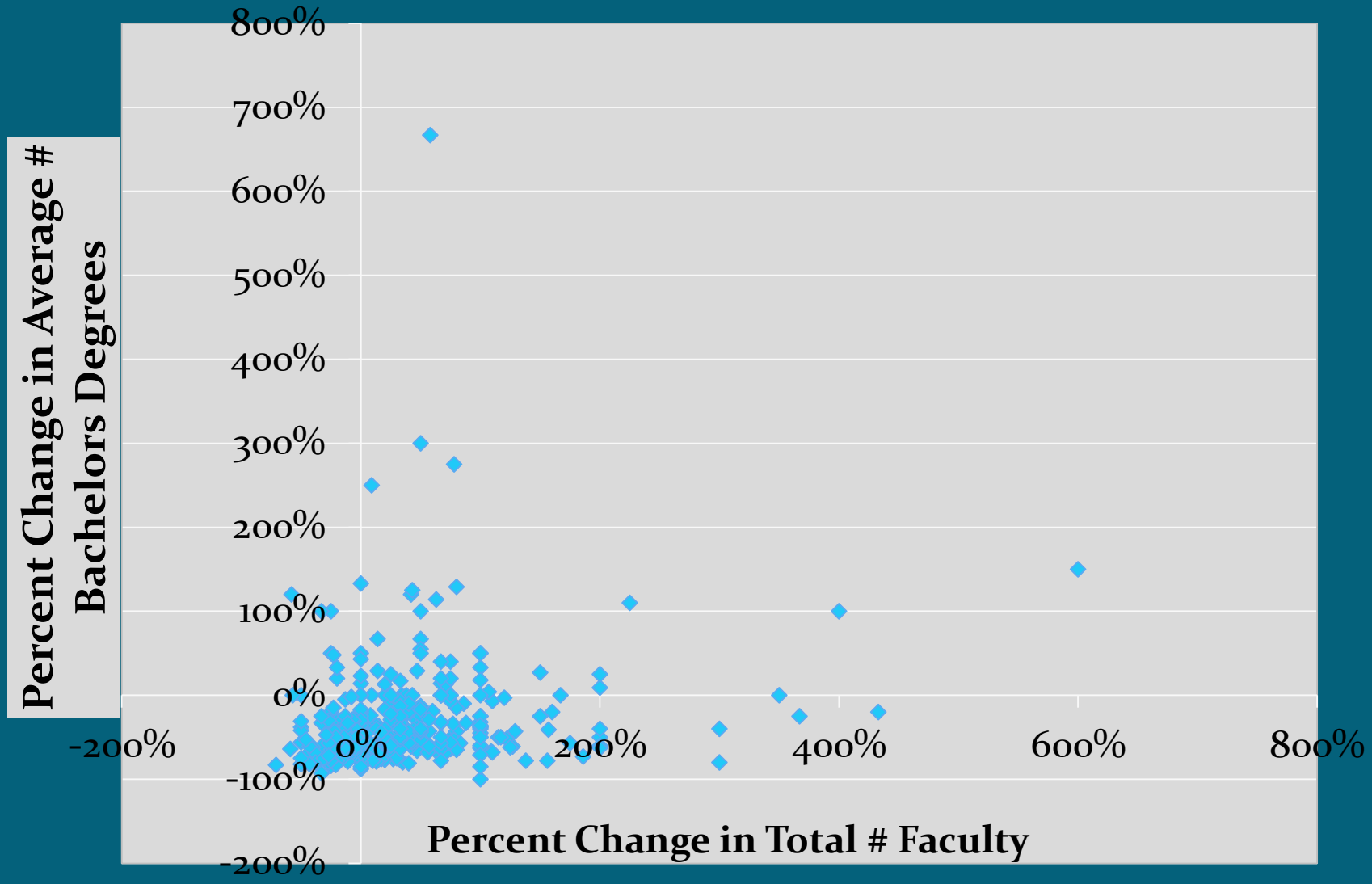
Change in Bachelor Degrees to Change in Faculty



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Faculty Degree Output: Then and Now

Institution	Faculty 1981/2011	Bachelor Degrees/faculty 1980s/2000s	Master Degrees/faculty 1980s/2000s	Doctorate Degrees/faculty 1980s/2000s
Purdue	25/44	1.44/0.41	0.76/0.14	0.2/0.16
Univ. of Washington	20/42	2.95/1.31	1.15/0.4	0.15/0.4
Colorado School of Mines	37/41	--/--	0.54/0.49	0.22/0.12
Cal Tech	29/39	0.21/0.15	0.28/0.18	0.34/0.21
UT Austin	31/37	3.71/1.3	1.06/0.68	0.1/0.35
Arizona State	20/36	1.05/0.33	0.5/0.25	0.25/0.17
Penn State	39/36	1.54/1.64	0.77/0.36	0.31/0.33
MIT	25/35	0.6/0.34	0.32/0.23	0.16/0.54
Texas A & M	37/35	2.38/0.94	1.38/0.74	0.19/0.34
Stanford	26/32	1.46/1.03	1.65/0.81	1/0.72
Univ. of Michigan	21/31	0.95/0.55	1/0.19	0.33/0.32
Ohio State	20/31	1.95/0.45	1/0.26	0.1/0.16
UCLA	29/30	0.76/0.37	0.45/0.3	0.2/0.23
Columbia University	19/30	0.16/0.77	0.63/0.47	0.63/0.4
Univ. of Colorado Boulder	25/29	2.44/0.62	0.8/0.31	0.36/0.28
Univ. of Houston	14/29	1.85/0.93	1.07/0.86	0.29/0.28
Univ. of Southern Calif.	13/28	0.77/0.18	1.15/0.14	0.15/0.25
Yale	20/27	0.75/0.11	0.5/0.04	0.3/0.19
Georgia Tech	18/26	--/0.5	0.61/0.42	0.17/0.38
Univ. of Utah	20/26	1.7/0.46	1.1/0.58	0.15/0.19
Averages	**24.6/33.9**	**1.47/0.66**	**0.82/0.37**	**0.29/0.30**

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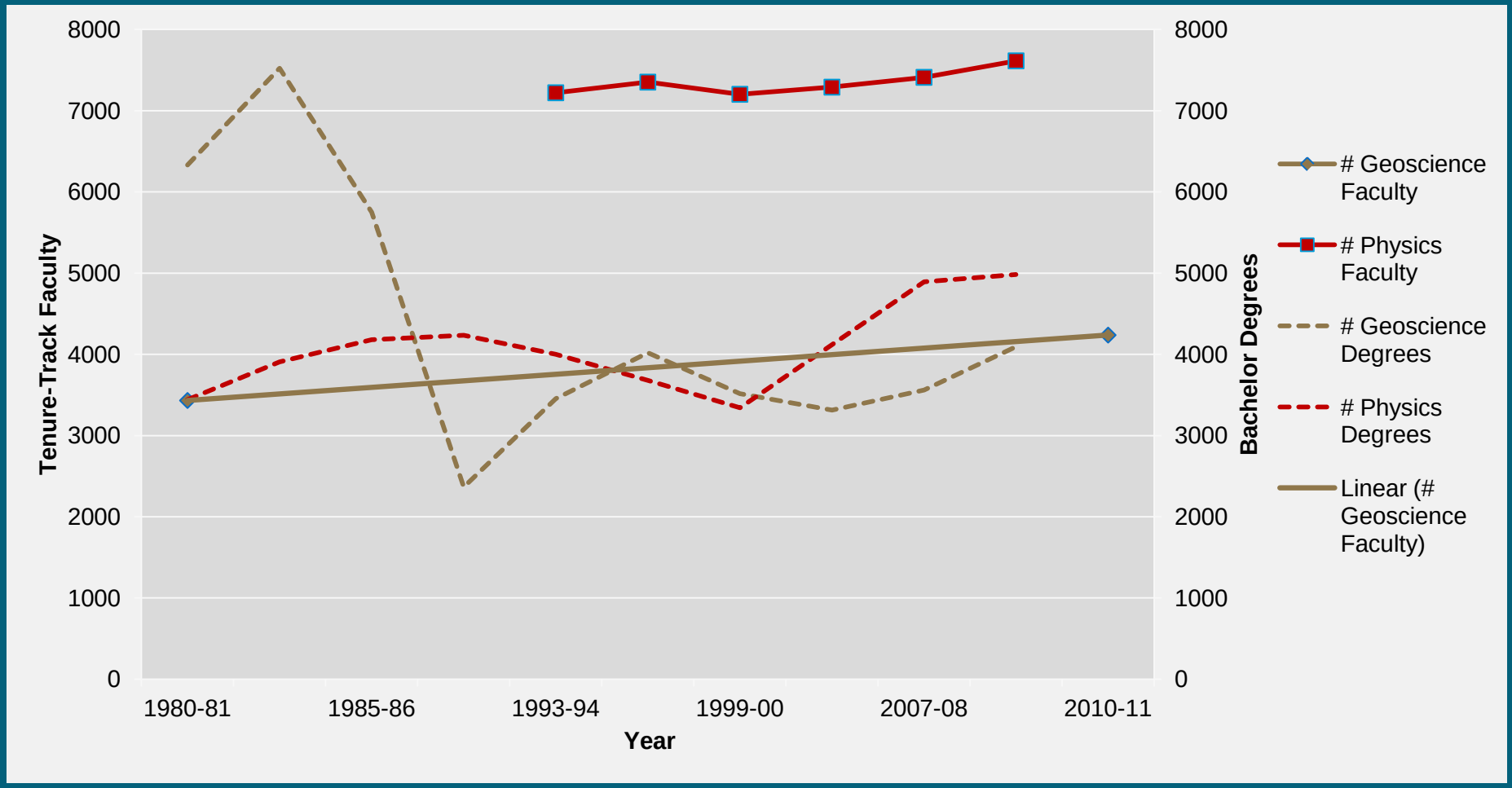
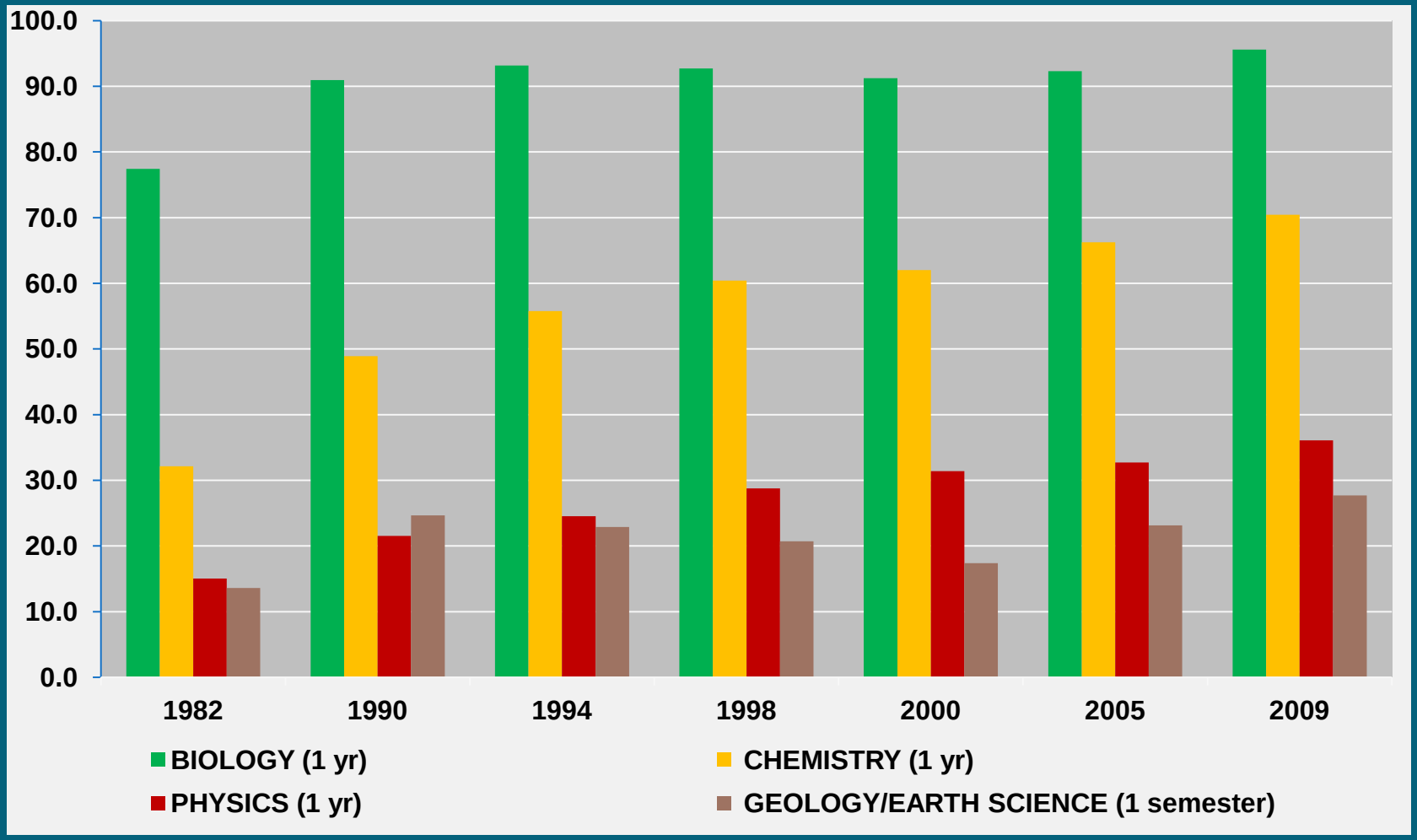
The Physics, Geoscience Analogue



Source: AIP *REPORT*, December 2005; AIP *focus on, April 2012;* NCES, Digest *of* Educational Statistics 2011; *Directory of Geoscience Departments*, 1981 and 2011

Percent of High School Graduates Taking Secondary Science Courses



Source: NCES, Digest *of* Educational Statistics 2011, Table 161

When the earth sciences really took off…

EARTH SCIENCE CURRICULUM PROJECT

escp

NEWSLETTER

NUMBER 20 • OCTOBER 1969

UNDERGRADUATE PRE-SERVICE PROGRAM

By J. Nathan Swift
State University of New York — College at Oswego
Oswego, New York 13126

In the May, 1969 issue of the ESCP *Newsletter*, Ed Stoever expressed several concerns in his article, "Undergraduate Teacher Preparation." One area of concern was a general lack of effective programs in professional education. Stating that there are some notable exceptions, Stoever described one program: "At one institution, staff in educational psychology and science education are cooperating in an experimental program wherein these two subjects are taught weekly in the schools where student teachers are assigned on a full-time basis for a full term. These student teachers have had only one general course in education prior to this 'professional semester.' These students are responsible for only two classes per day. They spend the rest of the time in the school system observing other classes in grades K-12, in studying, and in attending the on-site classes in educational psychology and science education. The arrangement appears to be successful, and another benefit is the involvement of and continuing education of the cooperating teachers." This is the program that has now seen two successful trials at the State University College in Oswego, New York.

Three needs, relevance of content, immediate and constant evaluation, and an uninterrupted time block, were the principal reasons for attempting a break from the conventional methods-student teaching sequence for the preparation of science teachers. The following is a description of some of our past experience with this approach.

Continued Page 2

ROMEY ASSUMES DIRECTORSHIP

William D. Romey assumed the responsibility of directing the Earth Science Curriculum Project on September 1. He received his Ph.D. in geology at the University of California at Berkeley. Romey was associate professor of geology and science education at Syracuse University where he has taught since 1962. He retains adjunct professor status at Syracuse while with ESCP.

His geologic interests include field and laboratory studies of anorthosites and associated rocks in the Adirondacks and in Norway. He has produced numerous articles based on his research.

In the field of science education, he has taught and carried out research in the area of teaching earth science in the secondary schools and at the introductory college level. His recent book, *Inquiry Techniques for Teaching Science* (Prentice-Hall, 1968), is a result of these activities.

Romey was a member of the 1964, 1965, and 1966 ESCP writing conferences which produced the preliminary and hardback versions of *Investigating the Earth*, both text and teacher's guide.

WILLIAM D. ROMEY

He is a fellow of the Geological Society of America, and a member of the National Association of Geology Teachers, the Mineralogical Society of America, and the National Science Teachers Association, and the National Association for Research in Science Teaching, among others.

Reflections On Undergraduate Goals

By William D. Romey

Many geology departments consider their primary goal to be the preparation of professional geologists, who will ultimately work in industry, the U.S. or State Geological Surveys or for colleges or universities. They believe that special programs in which they are not particularly interested are necessary for the preparation of high school teachers. A few teacher-training institutions have developed such special programs for future secondary-school earth science teachers. An emphasis on the general cultural values of the earth sciences has been mainly confined to schools which offer only limited programs in geology. Of course, every college and university offering any geology at all has its "service" course with similar goals. [illegible] different do these programs need to [illegible] Must a department follow one [illegible] route or have several distinct prog[illegible] And what are the needs of the [illegible] student populations?

Consider first the programs [illegible] to produce professional geol[illegible] an extreme case, a department [illegible] a PhD prep-school with a [illegible] cluding a heavy load of special[illegible] courses adding up to a large number of credit hours. What finally happens to students who move on into graduate programs? Although no exact figures are available, a careful survey would

Continued Page 4

1967-68 level in the seven states that haven't yet responded, there would be an additional 82,023 students enrolled in earth science. This gives an estimated total secondary earth science enrollment of 841,422. An estimate of the total public school 9th grade enrollment by the USOE is 3,218,000 making the earth science enrollment nationally about 26.2%. This estimated percentage is based on 9th grade population simply for the sake of comparison, recognizing that many of these students take earth science at other grade levels and in non-public schools.

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Market Assessment of Introductory Enrollment from the Publishers

2005

Introductory Physical Geoscience: 275,000
Environmental Geoscience: 50,000
Parks, Site Specific Lands: 12,000

2012

Introductory Physical Geoscience: 225,000
Environmental Geoscience: 50,000
Parks, etc. - - -

USGS

Source: Pearson Publishing Higher Education
Response to Data Request: 10/24/2012

Issues and Opportunities

Academic rankings not well-aligned with education, workforce or national science literacy components.

Relative size of geoscience departments can limit broader impacts and larger role of the professoriate.

Flow into the earth science academic pipeline is poor.

Greater detachment from corporate, governmental sectors over recent decades.

Complete faculty/degree data set available Nov. 30th at:
ftp://ftpext.usgs.gov/pub/er/va/reston/rridky/

USGS