2004 Gather

Genetics Summary

Genetic Analysis of the McCullough Peaks, WY HMA

E. Gus Cothran

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Department of Veterinary Integrative Bioscience
Texas A&M University
College Station, TX 77843-4458

The following is a report of the genetic analysis of the McCullough Peaks, WY HMA.

METHODS

A total of 51 blood samples were received by the University of Kentucky on October 12, 2004. Seventeen genetic marker systems were analyzed. Seven systems were red blood cell alloantigen loci (the *A, C, D, K, P, Q* and *U* horse blood groups) tested by standard serological methods of agglutination and compliment mediated hemolysis. The other 10 systems were biochemical polymorphisms detected by electrophoretic techniques. These systems were Albumin (*ALB*), Alpha-1-beta Glycoprotein *(A1B*), Serum Cholinesterase *(ES)*, Vitamin D Binding Protein *(GC)*, Glucose Phosphate Isomerase *(GPI)*, Alpha Hemoglobin (*(HB)*, Phosphoglucomutase *(PGM)*, Phosphogluconate Dehydrogenase *(PGD)*, Protease Inhibitor *(PI)*, and Transferrin *(TRF)*. In addition to the above genetic system, DNA was extracted from the blood samples and tested for variation at 12 equine microsatellite (mSat) systems. These were *AHT*4, *AHT*5 *ASB*2, *ASB*17, *ASB*23, *HMS*3, *HMS*6, *HMS*7, *HTG*4, *HTG*10, *LEX*33, and *VHL*20. These systems were tested using an automated DNA sequencer to separate Polymerase Chain Reaction (PCR) products.

A variety of genetic variability measures were calculated from the gene marker data. The measures were observed heterozygosity *(Ho)* which is the actual number of loci heterozygous per individual and is based upon biochemical loci only; expected heterozygosity *(He),* which is the predicted number of heterozygous loci based upon gene frequencies and was calculated for biochemical loci and all marker systems (*Het)*; effective number of alleles *(Ae)* which is a measure of marker system diversity; total number of variants *(TNV)*; and estimated inbreeding level *(Fis)* which is calculated as 1-*Ho/He*. These same measures were calculated for the mSat data. However, the DNA data will not be reported here due to limited comparative information.

Genetic markers also can provide information about ancestry in some cases. Genetic resemblance to domestic horse breeds was calculated using Rogers' genetic similarity coefficient, *S*. This resemblance was summarized by use of a restricted maximum likelihood (RML) procedure.

RESULTS AND DISCUSSION

Variants present and allele frequencies for the blood group and biochemical markers are given in Table 1. No variants were observed which have not been seen in horse breeds. Table 2 gives the values for the genetic variability measures of the McCullough Peaks horse herd, as well as results from two other samplings of this herd collected in 1991 and 1999. Also shown in Table 2 are values from a representative group of domestic horse breeds. The breeds were selected to cover the range of variability measures in domestic horse populations. Mean values for feral herds (based upon data from 54 herds) and mean values for domestic breeds (based upon 118 domestic horse populations) also are shown.

Mean genetic similarity of the McCullough Peaks herd to domestic horse breed types are shown in Table 3. A dendogram of relationship of the McCullough Peaks herd to a standard set of domestic breeds is shown in Figure 1.

Genetic Variants: A total of 63 variants were seen in the McCullough Peaks herd which is above the mean domestic horse breeds. Of these, 14 had frequencies below 0.05. This is about average for a feral herd and suggests little loss of variation. The 63 variants is two more than seen in 1991 and one more than in 1999. Overall, this indicates reasonably good consistency among the sampling periods.

Genetic Variation: Genetic variation in the McCullough Peaks herd in 2004 is well above the average for feral herds. *Ho* is one of the highest values seen for a feral herd while *He* also is

quite high. *Ho* is higher than *He*. The 2004 *Ho* also is a good deal higher than seen in previous years. The *TNV* and *Ae* also has gone up steadily since 1991 which would be related to the increase in heterozygosity. There are two main possibilities for this increase. One is that the past samples have not completely sampled the herd and new variation that was present is being revealed. The more likely cause is that there has been migration into the population from another source.

Genetic Similarity: Highest mean genetic similarity of the McCullough Peaks herd was with the Heavy Draft Breeds although all mean *S* values were low. Highest individual breed similarity was with the Percheron. The overall pattern of similarity values and variants present indicates mixed origins primarily with a strong draft component and with possibly some Spanish background. However, although the average similarity with Spanish breeds were next highest after draft, the values are low and no individual value with any Spanish breed indicated clear relationship. The 2004 data is similar to that for the previous years so no new analysis of relationships among Wyoming herds was done. Figure 2 is from the 1999 analysis.

SUMMARY

Genetic variability within the McCullough Peaks herd is high and has increased since the two previous sampling periods. The increase in variation most likely is due to continued input into the herd from other horse populations, although it does not appear that migration rate is high. The herd appears to be of mixed origins with a strong Draft Horse influence.

RECOMMENDATIONS

This herd has high genetic variability and continued management as has been implemented in the past adequate.

Table 1. Allele frequencies of genetic variants observed in the MCCULLOUGH PEAKS WY feral horse herd.

System	Allele	Frequency
Tf	D	.460
	F1	.010
	F2	.118
	G	.010
	H1	.059
	H2	.147
	O	.088
	R	.108
A1B	K	1.000
Es	F	.118
	G	.412
	I	.382
	L	.010
	R	.078
Al	A	.539
	B	.461
Gc	F	.663
	S	.337
PGD	F	.637
	S	.363
PGM	F	.020
	S	.980
GPI	F	.039
	I	.951
	S	.010
Hb	BI	.559
	BII	.441
Pi	H	.020
	I	.373
	L	.098
	L2	.059
	N	.039
	S	.225
	U	.186
A	adf	.420
	b	.090
	c	.127
	bc	.151
	bce	.062
	-	.150

C	a	.423
	-	.577
D	ad	.262
	d	.160
	dk	.164
	dghm	.088
	deo	.167
	dek	.032
	bcm	.039
	cgm	.078
	cegi	.010
K	a	.040
	-	.960
P	ac	.277
	ad	.277
	b	.010
	-	.436
Q	abc	.061
	ac	.032
	c	.194
	-	.713
U	a	.515
	-	.485

Table 2. Genetic variability measures.

	N	*Ho*	*He*	*Fis*	*Het*	*Ae*	*TNV*
McCullough Peaks, WY	51	0.431	0.419	-0.030	0.467	2.615	63
McCullough Peaks 1991	46	0.391	0.394	0.008	0.466	2.487	61
McCullough Peaks 1999	41	0.405	0.431	0.060	0.500	2.536	62
Thoroughbred	265	0.294	0.288	-0.019	0.325	2.009	64
Arabian	117	0.307	0.327	0.061	0.376	2.132	67
Andalusian	140	0.348	0.362	0.039	0.425	2.508	75
Shetland Pony	50	0.368	0.407	0.095	0.452	2.595	71
Welsh Pony	42	0.388	0.387	-0.002	0.453	2.603	76
American Saddlebred	259	0.404	0.409	0.013	0.435	2.625	96
Peruvian Paso	141	0.451	0.445	-0.014	0.469	2.761	77
Belgian Draft	82	0.427	0.415	-0.028	0.451	2.386	66
Feral Horse Mean	54	0.360	0.351	-0.035	0.385	2.218	53.5
Standard Deviation		0.051	0.053	0.118	0.067	0.339	12.5
Domestic Horse Mean	118	0.371	0.365	-0.014	0.414	2.398	65.4
Standard Deviation		0.049	0.043	0.065	0.039	0.253	11.1

Table 3. Rogers' genetic similarity of the McCullough Peaks feral horse herd to major groups of domestic horses.

	Mean *S*	Std	Minimum	Maximum
Light Racing and Riding Breeds	0.792	0.024	0.744	0.822
Oriental and Arabian Breeds	0.800	0.023	0.765	0.844
Old World Iberian Breeds	0.797	0.024	0.775	0.816
New World Iberian Breeds	0.805	0.023	0.754	0.833
North American Gaited Breeds	0.808	0.023	0.771	0.835
Heavy Draft Breeds	0.813	0.021	0.751	0.867
True Pony Breeds	0.785	0.025	0.743	0.845

Figure 1. Partial RML tree of genetic similarity to domestic horse breeds.

```
                          +--MORGAN HORSE
                       +----|
                       |    |      +----STANDARDBRED PACER
                       |    +------|
                    +--|           +------STANDARDBRED TROTTER
                    |  |
                    |  |      +----AMERICAN SADDLEBRED
                    |  |  +---|
                    |  +--|   +-------ROCKY MOUNTAIN HORSE
                    |     |
                    |     +-------TENNESSEE WALKER
                    |
                 +--|     +--QUARTER HORSE
                 |  |     |
                 |  |  +--|  +----HANOVARIAN
                 |  |  |  |  |
                 |  |  |  |  |     +--------TRAKEHNER
                 |  |  |  +--|  +--|
                 |  |  |     |  |  |  +-----------HOLSTEIN
                 |  |  |     |  |  +--|
                 |  |  |     +--|     |  +-----THOROUGHBRED
                 |  +--|        |     +--|
                 |     |        |        +----WIELKOPOLSKI
              +--|     |        |
              |  |     |        +-------SELLA FRANCAIS
              |  |     |
              |  |     |      +-----KHUZESTAN ARABIAN
              |  |     |   +--|
              |  |     |   |  |  +ARABIAN
              |  |     +---|  +--|
              |  |         |     +---------SHAGYA ARABIAN
           --|  |         |
              |  |         +----------KURD
              |  |
              |  |  +---------------AKHAL TEKE
              |  +--|
              |     |  +-----------CASPIAN PONY
              |     +--|
              |        +-----TURKOMAN
              |
              +---------MCCULLOUGH PEAKS
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Figure 2. Dendrogram of genetic similarity among Wyoming feral herds.

```
                        SIMILARITY

.76      .80       .84       .88       .92       .96     1.00
----+----+----+----+----+----+----+----+----+----+----+---+

                                +------------------------- Stewart Creek
                           +-----|
                           |    +------------------------- Eagles Nest
                      +----|
                      |    |       +----------------------- Cooper Creek
                    +-|    +-------|
                    | |            +----------------------- Green Mountain
          +--------| |
          |         | +------------------------------------ White Mountain
       +--|         |
       |  |         +------------------------------------- Happy Creek Springs
     +-|  |
     | |  +---------------------------------------------- 15 Mile Herd
   +-| |
   | | +------------------------------------------------- Cedar Ridge Trap
   | |
  +| +-------------------------------------------------- Tilley Creek
  ||
  ||                            +------------------------- McCullough Peaks
  ||                         +-|
 +|+-------------------------| +------------------------- Whistle Creek
 ||                          |
 ||                          +---------------------------- Dry Creek
 ||
 |+------------------------------------------------------ Cold Springs Trap
 |
 +------------------------------------------------------- Muskrat Basin

----+----+----+----+----+----+----+----+----+----+----+---+
.76      .80       .84       .88       .92       .96     1.00
```

Appendix 1. Blood group and biochemical data for individual horses of the McCullough Peaks WY feral horse herd.

```
          Biochemical Systems
Blood Group Systems
Accno.   Loc  TF   A1B  ES   AL   GC   PGD  PGM GPI   HB    PI
A       C D              K P    Q   U
-----------------------------------------------------------------------
04-09254 rp60 H1H2 K K  G G   A A  F F  S S  S S  I I  B1B1   S S
-bc-- - - -bcd---- k m-- - a-   --- a
04-09255 rp60 D H2 K K  I I   A A  F S  F F  S S  I I  B1B2   U U
abcd- - - ---d---- - -n- - --   --- a
04-09256 rp60 D H2 K K  G G   A B  F S  F S  S S  I I  B1B2   U U
-bc-- - a ---d---- k -n- - a-   --- a
04-09257 rp60 D H2 K K  G G   A B  F S  F F  S S  I I  B1B1   I L
a--d- - a --cd--g- k m-- - a-   --- a
04-09258 rp60 D R  K K  I I   A A  S S  F F  S S  I I  B1B2   I U
-bc-- - a --cd--g- k m-- - a-   --- a
04-09259 rp60 D H1 K K  G I   A B  F F  F S  S S  I I  B1B2   I I
a--d- - - a--de--- - --o - a-   --- a
04-09260 rp60 D D  K K  G R   A A  F S  S S  S S  I I  B1B2   I L2
ab-d- - a a--d---- - -n- - a-   --c a
04-09261 rp60 H1O  K K  G I   A B  S S  F S  S S  I I  B1B2   I S
a--d- - - a--d---- - --- - a-   --- a
04-09262 rp60 D O  K K  G I   B B  F F  F F  S S  I I  B1B2   I L
a--d- - - a--de--- - --o - --   --- -
04-09263 rp60 G F2 K K  G G   A B  F S  F F  S S  F I  B1B1   I L2
a-cd- - a ---de--- - -no - ab   --- a
04-09264 rp60 D H2 K K  G G   B B  F F  F S  S S  I I  B2B2   H L2
ab-d- - a a--d---- k --- - a-   --- a
04-09265 rp60 D H2 K K  G I   A A  F S  F F  S S  I I  B1B2   I I
abcd- - a ---de--- - -no - a-   --- a
04-09266 rp60 D D  K K  G I   A B  F F  F S  S S  I I  B1B1   N S
abcd- - - a--d---- - --- a a-   --c -
04-09267 rp60 D D  K K  F I   A B  F F  S S  S S  I I  B1B2   I U
-bc-e - - a--de--- k --  - a-   --- -
04-09268 rp60 H2R  K K  F G   B B  F F  S S  S S  I I  B2B2   I N
a-cd- - a a--d---- - -n- - a-   --- a
04-09269 rp60 D R  K K  I R   A B  F S  F F  S S  I I  B1B2   I S
-bc-- - a ---d--gh k m-- - a-   --- a
04-09270 rp60 D F2 K K  G R   A B  S S  F S  S S  I I  B1B2   L2S
a--d- - - ---de--- - -no a a-   --c -
04-09271 rp60 D D  K K  F I   A B  F F  F F  S S  I I  B1B2   L U
-bc-e - a ---de--- k --- - a-   a-c a
04-09272 rp60 D D  K K  G I   A B  F F  F F  S S  I I  B1B2   L S
-bc-- - a --cde-g- - m-o - a-   --c a
04-09273 rp60 D F2 K K  F G   A B  S S  S S  S S  I I  B1B1   I S
a--d- - a ---de--- - --o - a-   --c a
04-09274 rp60 F2R  K K  G G   A B  F F  F F  S S  I I  B1B2   U U
-bc-- - - ---d--gh - mn- - a-   --- a
04-09275 rp60 H2O  K K  I R   A B  F S  F S  S S  I I  B1B2   L S
a--d- - a a--d---- - --- - --   abc a
04-09276 rp60 H2R  K K  G I   A A  F F  F S  S S  I I  B1B2   I I
ab-d- - a --cde-g- k mn- - a-   --- a
04-09277 rp60 D H1 K K  G R   B B  F S  F F  S S  F I  B1B2   I S
abcd- - a ---d---- k -n- - --   --- a
```

```
04-09278 rp60 D F2 K K  F I   A B  F F  S S  S S  I I  B1B1   I S
-bc-e - a -bcde--- - m-o - a-   abc a
04-09279 rp60 D O  K K  I I   A A  F F  F F  S S  I I  B1B2   I U
a-cd- - a a--d--gh - m-- - --   abc -
04-09280 rp60 D D  K K  G I   B B  F S  F S  S S  I I  B1B1   I S
-bc-- - a a-cd--g- - m-- a a-   --c a
04-09281 rp60 D O  K K  I R   A B  F S  F S  S S  I I  B1B2   S S
abcd- - - a--d---- - --- - a-   --c -
04-09282 rp60 D R  K K  G I   A B  S S  F S  S S  I I  B1B1   I L2
-b--- - - --cd--gh - m-- - --   --c a
04-09283 rp60 D D  K K  I I   A B  F F  F F  S S  I I  B1B2   I I
a--d- - a a--d--gh - m-- - a-   abc -
04-09284 rp60 R R  K K  G G   A B  F S* S S  S S  I I  B1B2   I U
a--d- - a ---d---- k -n- - --   --c a
04-09285 rp60 D D  K K  G I   A B  S S  F S  S S  I I  B1B1   I S
a--d- - a ---d--gh - mn- - --   --c a
04-09286 rp60 D R  K K  G G   A B  F S  S S  S S  I I  B1B1   I S
a--d- - a ---d---- k --- - a-   --c a
04-09287 rp60 D O  K K  G I   A A  F S  F S  S S  I I  B1B2   N S
a--d- - a a--d---- - -n- - a-   --c -
04-09288 rp60 D F2 K K  F R   A A  F F  F F  S S  F I  B2B2   U U
-bc-e - a ---de-gh - m-o - a-   a-c a
04-09289 rp60 D O  K K  I R   A B  F F  F S  S S  F I  B2B2   L U
a-cd- - a -bcd---- - mn- - a-   --c a
04-09290 rp60 D F2 K K  F F   B B  F F  F F  S S  I S  B1B1   I L
----- - a ---de--- - --o - a-   abc -
04-09291 rp60 F2H2 K K  G I   A B  S S  S S  S S  I I  B1B2   I S
a--d- - a a--d---- - -n- - a-   --- -
04-09292 rp60 D D  K K  F I   A B  F S  F F  S S  I I  B1B1   I U
-b--- - - --cde-g-   m-- - a-   a-c a
04-09293 rp60 D F2 K K  G G   A B  F S  F F  S S  I I  B1B2   H L2
a--d- - a a--d---- k --- - a-   --- a
04-09294 rp60 D F2 K K  F I   A A  F F  F F  S S  I I  B2B2   S S
-bc-- - a ---de--- - --o - --   --- a
04-09295 rp60 D H2 K K  G I   A B  S S  F F  S S  I I  B1B2   I I
a-cd- - - ---d---- k -n- - a-   --- a
04-09296 rp60 F2H2 K K  I I   A B  F S  F S  F S  I I  B2B2   N U
a-cd- - a ---d---- k -n- - a-   --- a
04-09297 rp60 D H2 K K  F I   A B  F F  F F  S S  I I  B1B2   L U
abcde - - -bcd--gh - m-- - a-   abc a
04-09298 rp60 F2R  K K  F I   A B  F S  F F  S S  I I  B1B2   I U
-b -e - - --cde-g- - m-o - a-   --- a
04-09299 rp60 D H2 K K  I L   A B  F F  F F  F S  I I  B1B2   I U
a--d- - a ---de--- - --o a a-   --- -
04-09300 rp60 D F1 K K  G I   A B  F S  F F  S S  I I  B2B2   I I
a-cd- - - a--d---- - -n- - a-   --- a
04-09301 rp60 H1R  K K  G G   A B  F F  F S  S S  I I  B1B1   I L
-bc-- - a a--d---- - -n- - --   --c a
04-09302 rp60 D H1 K K  G I   A B  F F  F F  S S  I I  B2B2   L S
--c-- - a --cd--gh - m-- - a-   --- a
04-09303 rp60 D H2 K K  G I   A B  F F  S S  S S  I I  B1B1   I S
a--d- - - ---d---- k --- - a-   --c a
04-09304 rp60 O O  K K  G I   A B  F F  F S  S S  I I  B1B2   I S
a--d- - a a--d---- - --- - a-   --c -
```

Appendix 2. DNA data for the McCullough Peaks WY feral horse herd.

ID		Microsatellite Loci															
		VHL20	HTG4	AHT4	HMS7	H	AHT5	HMS6	ASB2	HTG10	HTG7	HMS3	HMS2	ASB17	ASB23	LEX33	LEX3
04-09254	rp63	IJ	MO	OO	LL	**	LN	MP	OR	IL	**	MP	**	MM	KK	KK	LM
04-09255	rp63	OR	LM	JO	**	**	**	**	IM	OO	**	MP	**	HN	KU	QQ	MN
04-09256	rp63	IJ	MP	JK	LM	**	KN	MO	IM	MO	**	MN	**	RR	JK	LR	HO
04-09257	rp63	IO	MO	JO	LN	**	LQ	MM	IO	MO	**	PP	**	SS	KU	LQ	FP
04-09258	rp63	IO	MO	JO	LN	**	**	**	**	MO	**	**	**	**	KU	**	**
04-09259	rp63	IO	MO	JJ	LN	**	JL	MP	IN	MO	**	PR	**	MO	KU	KQ	LM
04-09260	rp63	PR	MP	**	**	**	**	**	IN	MM	**	PP	**	NP	KU	**	**
04-09261	rp63	OO	MP	OO	LN	**	KL	MO	MN	LR	**	NN	**	MS	KU	LQ	MN
04-09262	rp63	OO	MP	JO	LM	**	JQ	MP	NN	LM	**	NP	**	RS	KS	LR	HM
04-09263	rp63	IO	MP	JO	LM	**	**	MP	NN	IQ	**	NP	**	**	KS	**	**
04-09264	rp63	OP	MM	KO	LM	**	JK	LP	MN	KO	**	PP	**	NR	LS	GQ	OP
04-09265	rp63	IO	MO	IJ	LL	**	JJ	LP	OO	LM	**	MP	**	MP	KK	QQ	HO
04-09266	rp63	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
04-09267	rp63	OO	MM	JK	LM	**	KL	MP	MR	MR	**	NN	**	MS	GS	LQ	MN
04-09268	rp63	IO	MP	OO	NP	**	LO	MO	MR	IM	**	NN	**	MO	KU	LQ	MM
04-09269	rp63	IL	MO	JN	LN	**	LN	OP	MM	MR	**	NP	**	QR	KU	LQ	MO
04-09270	rp63	JO	MP	NO	LN	**	MM	LP	IR	KO	**	PP	**	NS	KK	KQ	LL
04-09271	rp63	OR	MP	**	LN	**	MM	LP	**	LM	**	PP	**	NR	KK	**	MN
04-09272	rp63	IO	OP	JO	LN	**	LM	MP	IO	MR	**	PP	**	RS	KL	LQ	FH
04-09273	rp63	IO	OP	JO	LN	**	LM	MP	IO	KM	**	PP	**	RS	KL	LQ	FH
04-09274	rp63	OR	MM	HJ	MM	**	JL	LP	MM	OO	**	PP	**	GH	KU	QQ	MM
04-09275	rp63	OO	PP	OO	LL	**	KN	MP	NR	RR	**	NP	**	MS	KU	LL	FM
04-09276	rp63	OR	MO	JJ	LL	**	JJ	LL	IO	LO	**	PR	**	RS	KU	LQ	LN
04-09277	rp63	IL	MO	JN	LL	**	NQ	PP	MM	MM	**	NP	**	RS	UU	LQ	LM
04-09278	rp63	JO	MM	JO	MN	**	LN	OP	KK	IM	**	NP	**	MR	KU	KQ	MM
04-09279	rp63	IO	MP	OO	MN	**	JN	OO	MR	RR	**	NN	**	RS	SU	OQ	MN
04-09280	rp63	IO	MP	JO	LM	**	JM	OP	OR	OR	**	PP	**	MR	KU	QQ	HM
04-09281	rp63	IO	PP	NO	LM	**	LM	OO	NR	OR	**	NP	**	MR	SU	OQ	MN
04-09282	rp63	OO	KP	IJ	LL	**	JJ	KM	NO	KL	**	IM	**	NS	KK	GG	NP
04-09283	rp63	JO	MP	HO	LP	**	KO	MP	IK	MO	**	PP	**	MM	KU	LL	LO
04-09284	rp63	IO	MM	HH	LL	**	JL	LP	KM	OO	**	MP	**	RS	KK	LQ	MM
04-09285	rp63	NP	MP	HJ	LN	**	JJ	LP	MO	MM	**	MP	**	NN	KS	QQ	OP
04-09286	rp63	II	MO	HO	LL	**	JM	MP	KN	LO	**	MP	**	MS	KU	QQ	FM
04-09287	rp63	IJ	MP	NO	LL	**	MM	MP	II	LO	**	NP	**	SS	KS	KR	MM
04-09288	rp63	IO	MP	NO	LL	**	MM	MP	II	OR	**	PP	**	**	KS	**	MM
04-09289	rp63	OR	MM	JK	LL	**	LM	OP	MR	OR	**	PP	**	SS	KU	LO	MM
04-09290	rp63	JO	MM	NO	MN	**	LM	OP	KR	IM	**	MP	**	NR	KU	KQ	MM
04-09291	rp63	**	**	**	**	**	**	**	IN	KR	**	NP	**	**	**	**	**
04-09292	rp63	JR	MP	JO	LM	**	JM	LO	OR	IM	**	MP	**	RR	KU	KQ	MN
04-09293	rp63	IO	MM	JO	LM	**	KL	MP	IK	KO	**	NP	**	NN	KU	GQ	LP
04-09294	rp63	JO	MP	OO	LL	**	LM	KP	IR	MR	**	NP	**	NR	KL	KL	HH
04-09295	rp63	IR	OO	JJ	LL	**	JJ	LP	IO	LQ	**	MR	**	NQ	SU	LQ	OO
04-09296	rp63	RR	MP	OO	MN	**	KN	OP	KN	IR	**	MP	**	RR	IS	QR	KO
04-09297	rp63	IO	MM	JO	LN	**	KL	PP	IM	OR	**	MR	**	HS	KK	KO	MM
04-09298	rp63	OO	MP	JO	**	**	**	**	**	LL	**	MN	**	NR	**	**	**
04-09299	rp63	II	MP	JJ	LM	**	OQ	MP	MN	KL	**	NN	**	NR	KS	LO	HO
04-09300	rp63	IR	MM	JJ	LN	**	LQ	MO	IM	IN	**	NN	**	OP	LU	LR	LO

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04-09301 rp63 IM LO HJ LM ** JM LP IM OO ** PP ** MR JK LL MN
04-09302 rp63 IO MM JN LN ** LN MO IM IR ** NP ** QS KK LQ MP
04-09303 rp63 II MO OO LL ** MN MM NO LM ** NP ** MM SU KQ FL
04-09304 rp63 OO MP OO LM ** JM MO MN LR ** MN ** MS SS OR MN
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